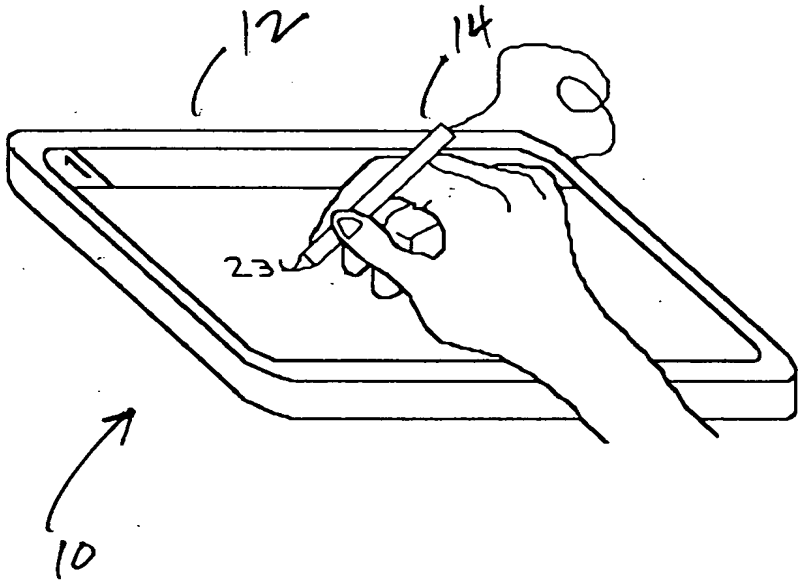

Fig. 1

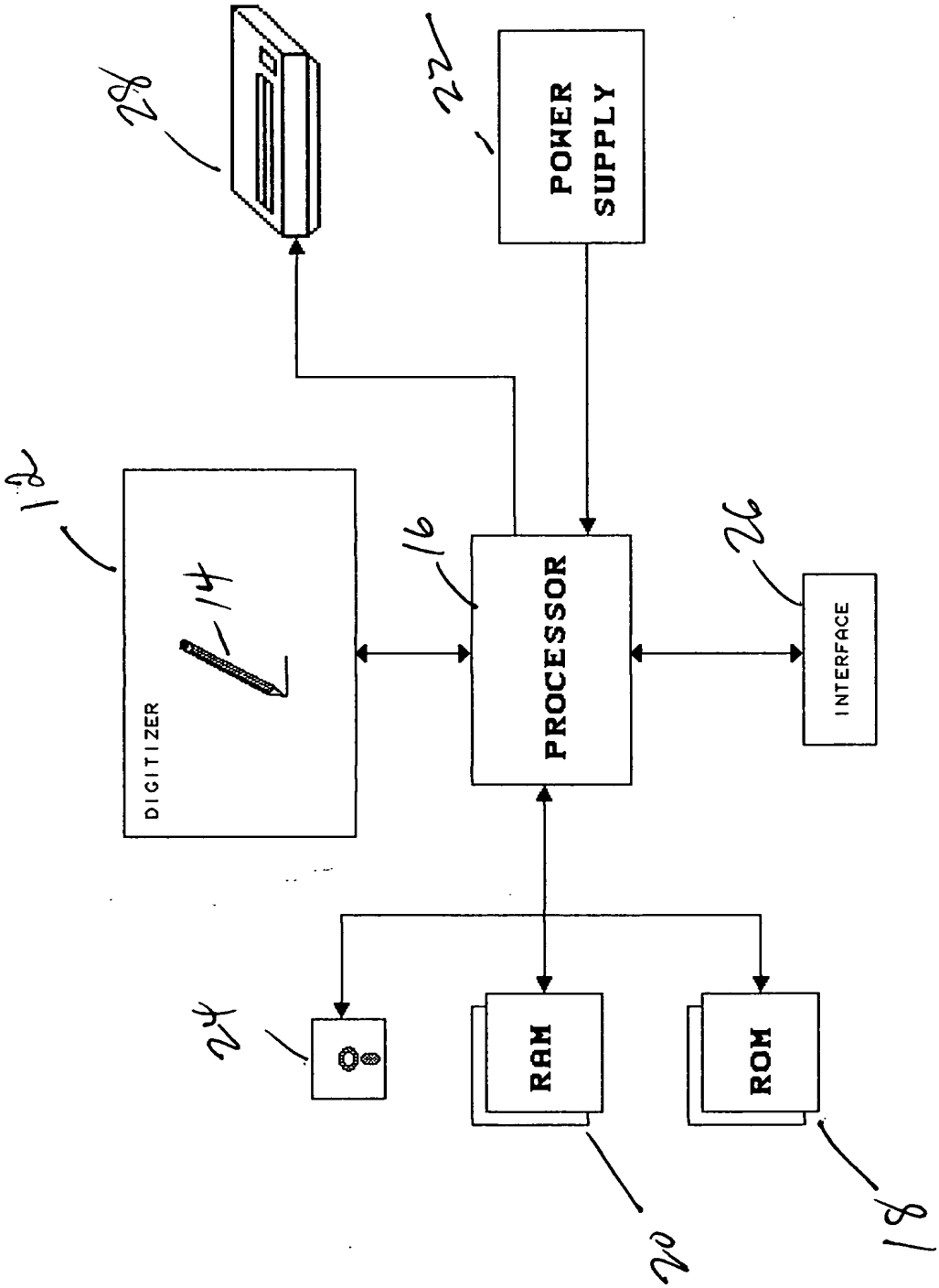
28
27
POWER SUPPLY
12
14
DIGITIZER
16
PROCESSOR
26
INTERFACE
24
RAM
20
ROM
18

FIG 2

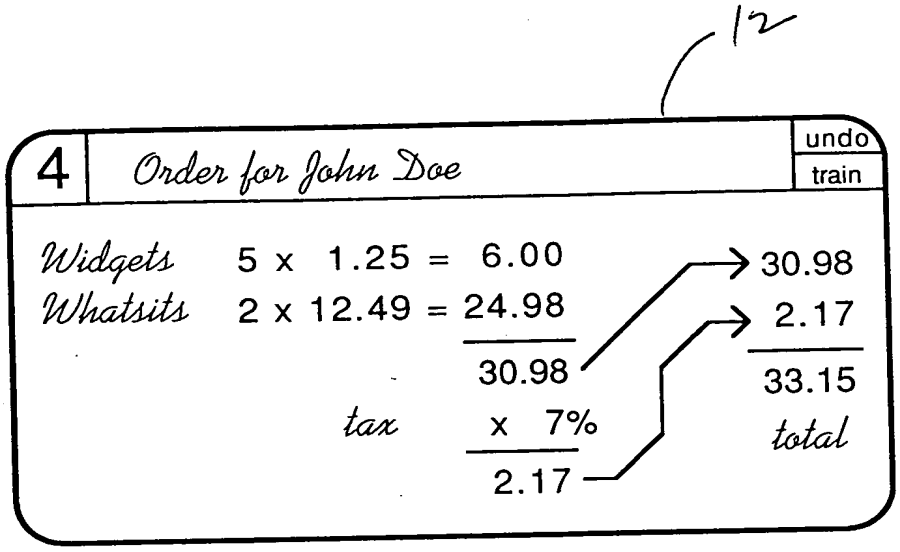
12
4
Order for John Doe
undo
train
Widgets 5 x 1.25 = 6.00
Whatsits 2 x 12.49 = 24.98
30.98
30.98
tax x 7%
2.17
2.17
33.15
total

Fig. 3

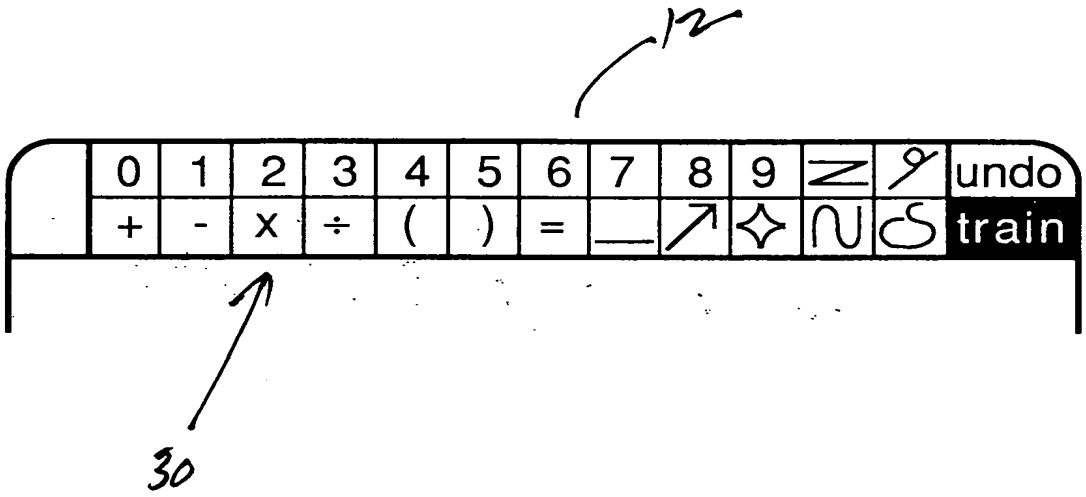

Fig. 4

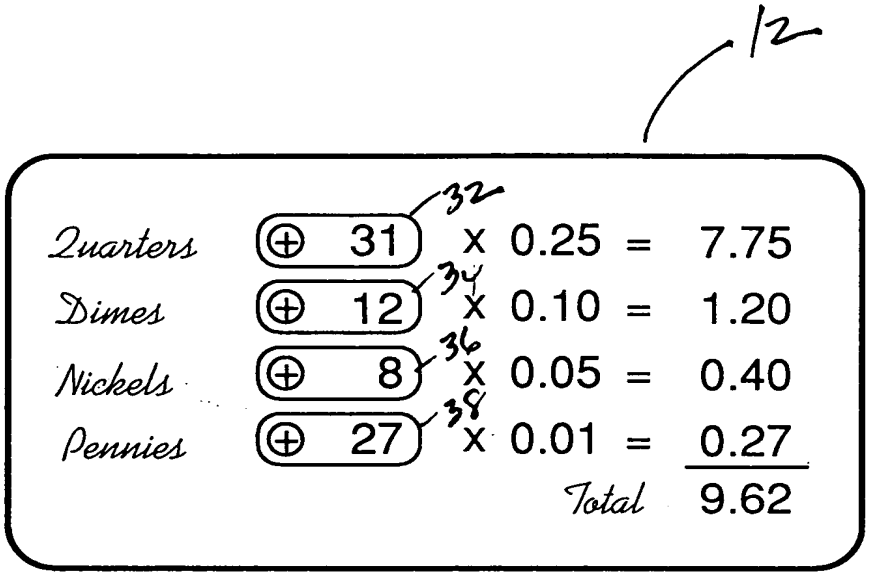
12
Quarters
31
32
x 0.25 = 7.75
Dimes
12
34
x 0.10 = 1.20
Nickels
8
36
x 0.05 = 0.40
Pennies
27
38
x 0.01 = 0.27
Total
9.62

Fig. 5

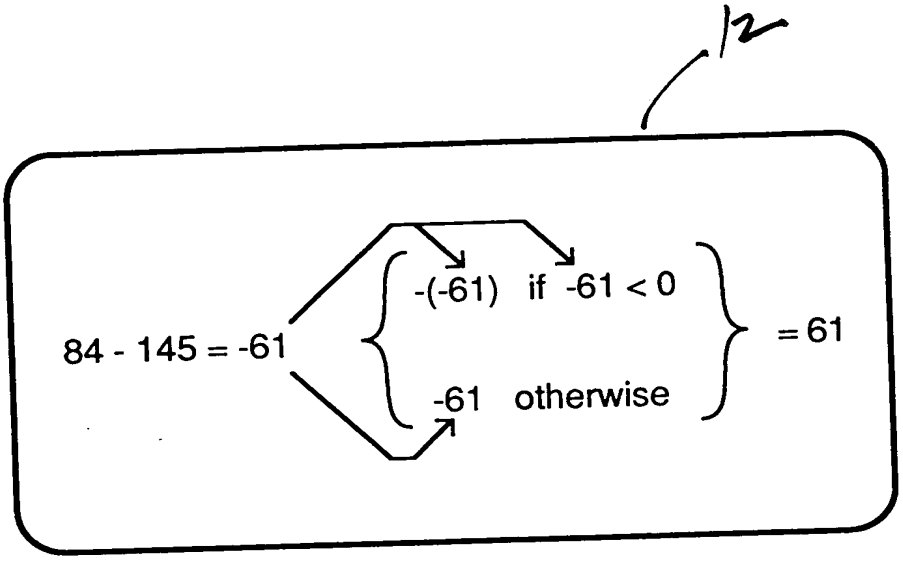

Fig. 6

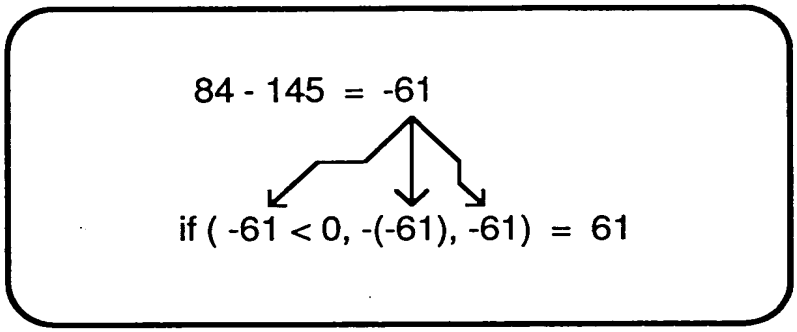

Fig. 7

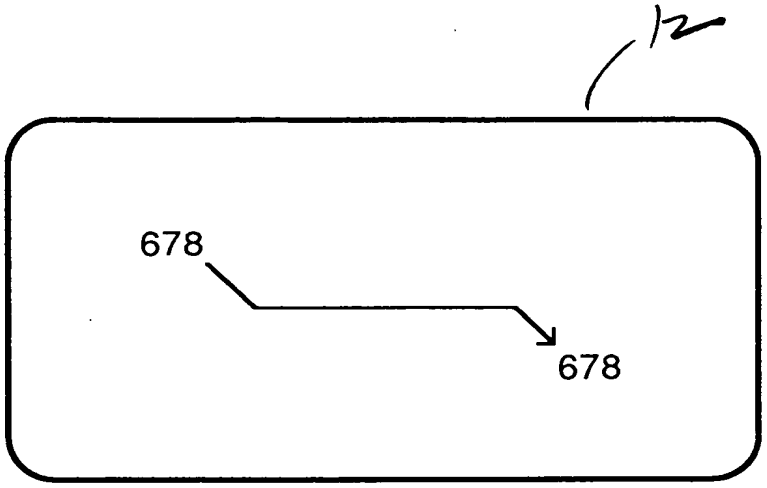

Fig. 8

12

Sales	3,260.6
Cost of Goods	-2,725.0
Administrative	-395.1
Operating Income	140.5
Rental Income	6.9
Property Sales	19.6
Interest Expense	-15.3
Miscellaneous	1.0
Other Income	10.2
Taxes	-52.0
Profit	100.7

Fig. 9

12

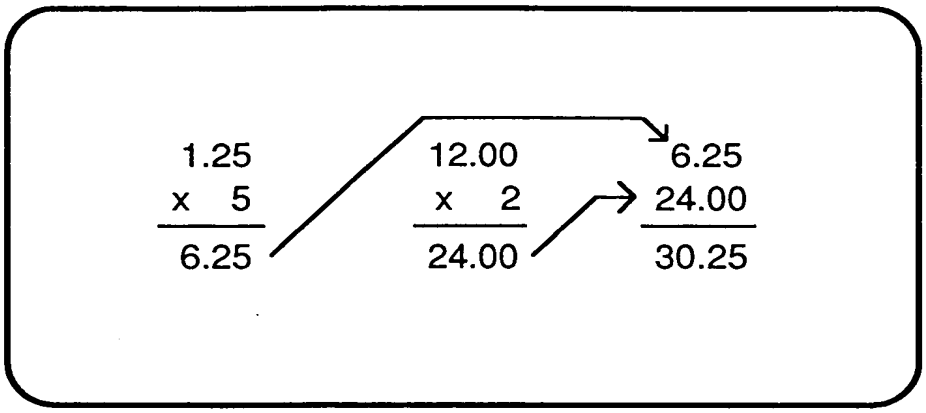

Fig. 10

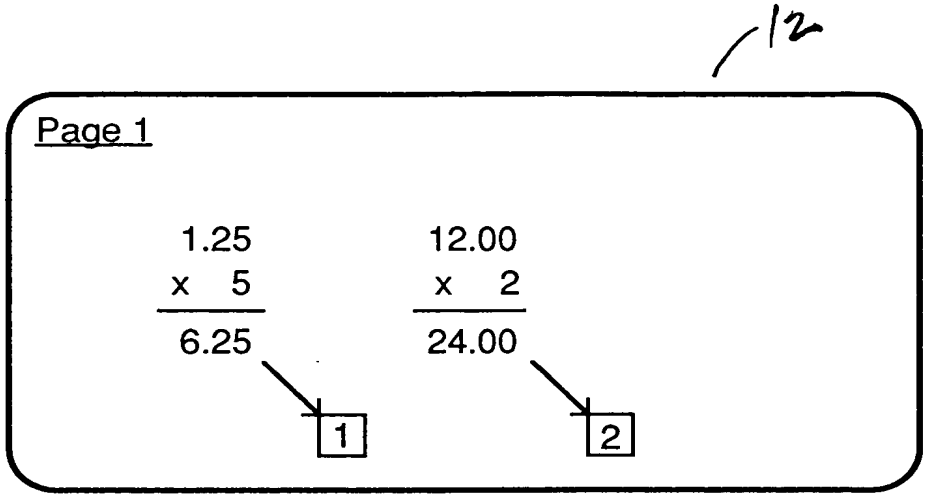

Fig. 11A

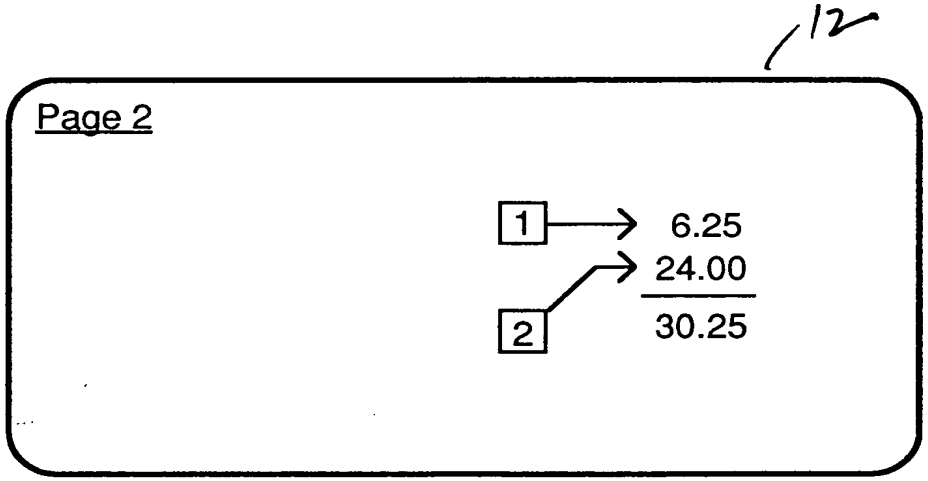

Fig. 11B

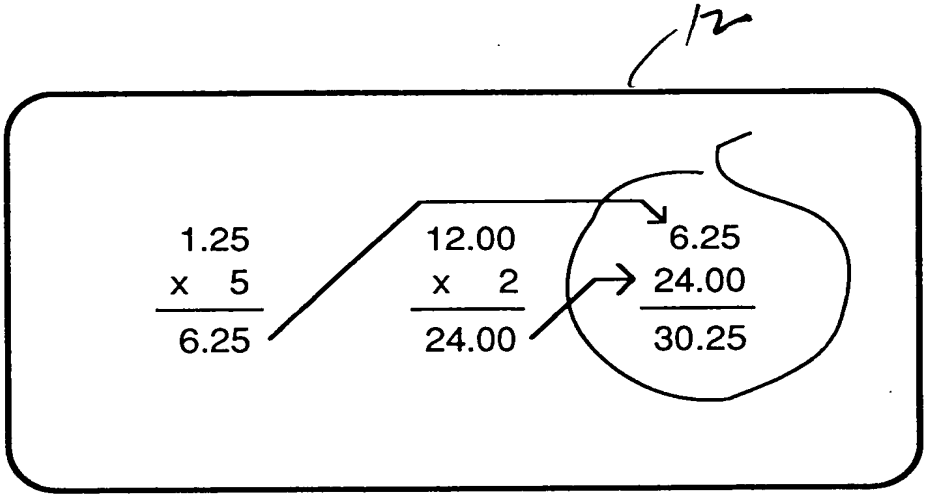

Fig. 12A

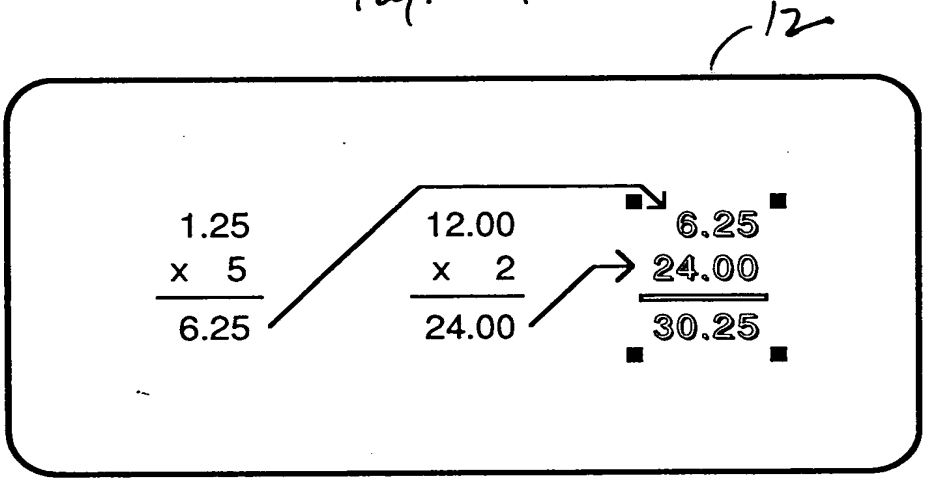

Fig. 12B

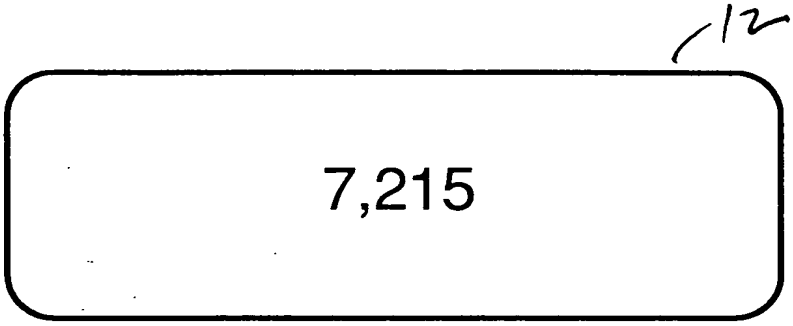

Fig. 13A

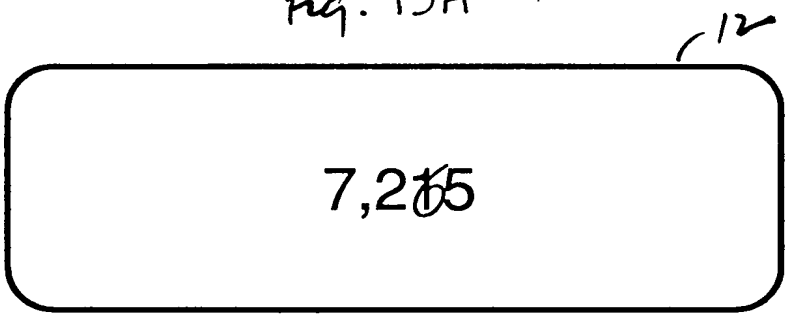

Fig. 13B

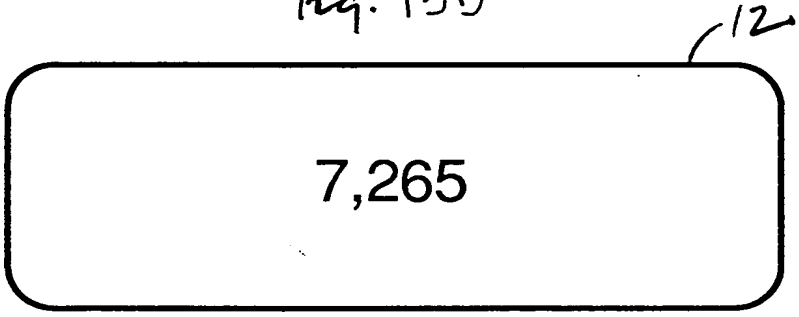

Fig. 13C

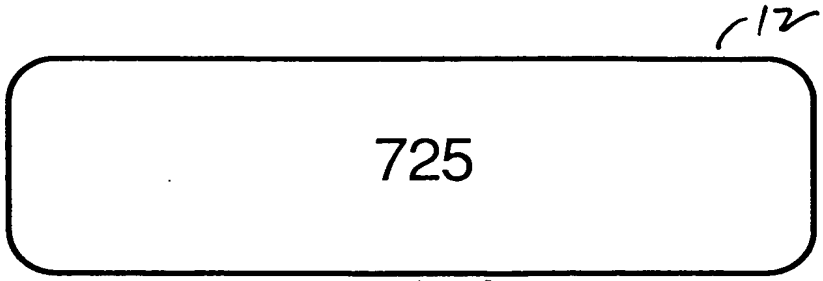

Fig. 14A

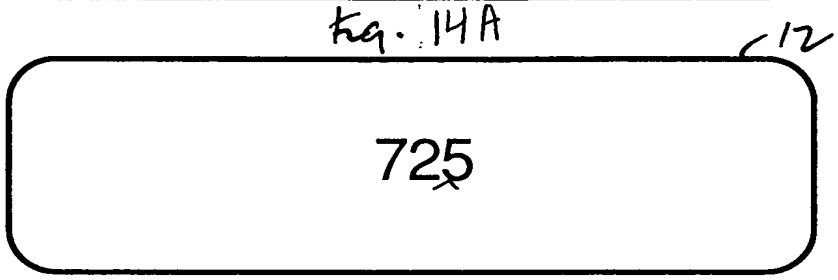

Fig. 14B

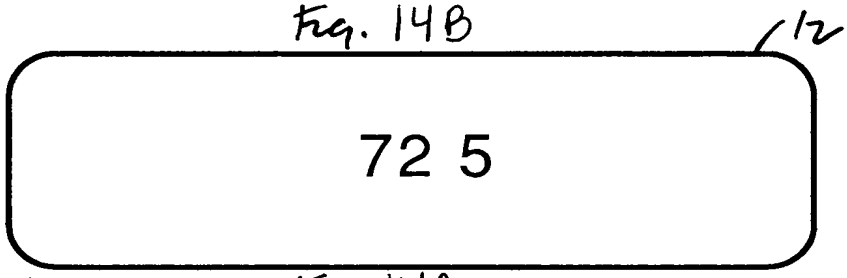

Fig. 14C

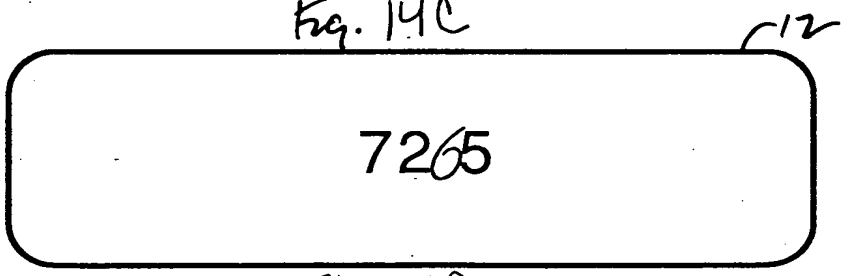

Fig. 14D

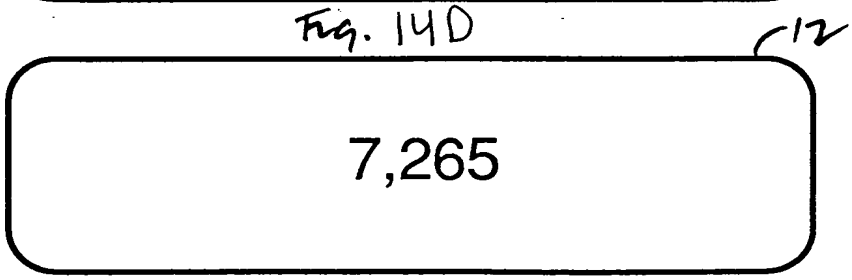

Fig. 14E

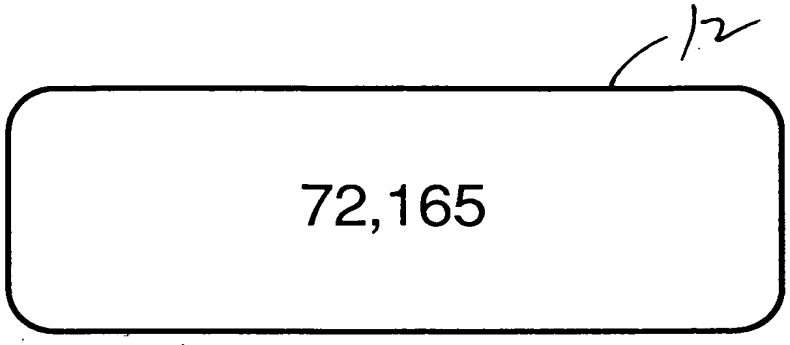

Fig. 15A

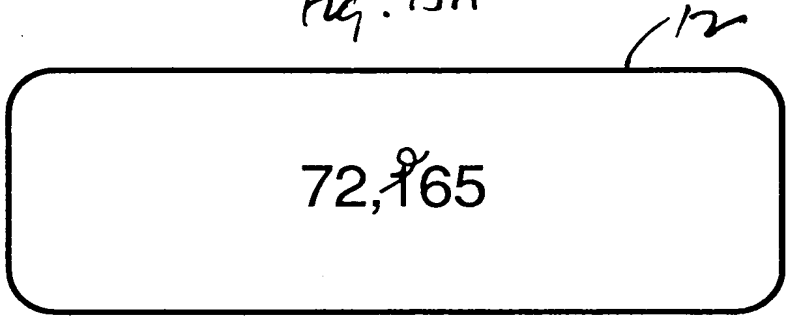

Fig. 15B

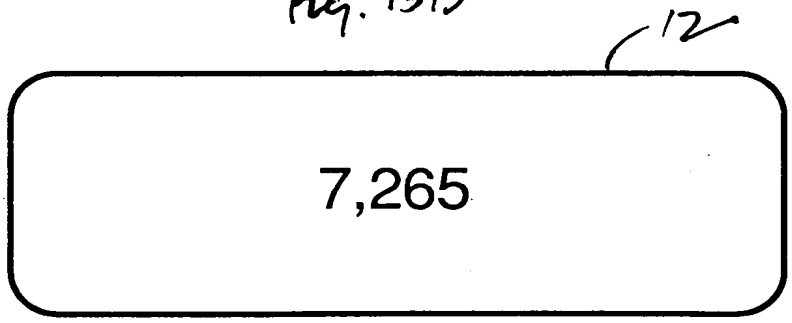

Fig. 15C

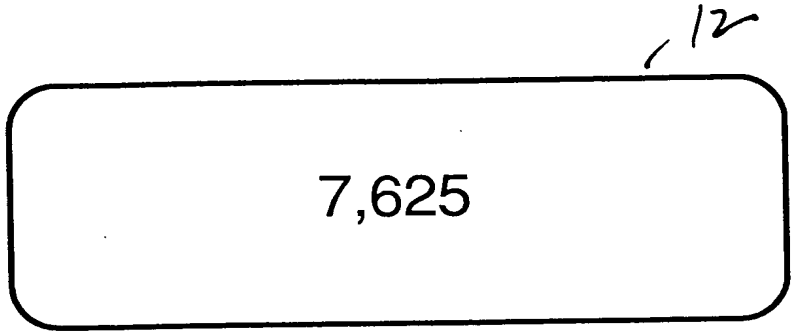

Fig. 16A

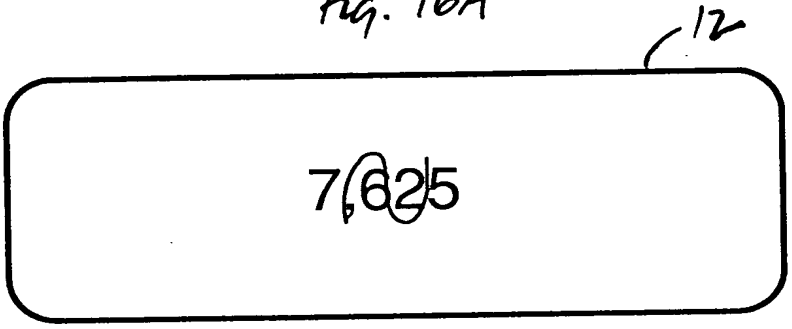

Fig. 16B

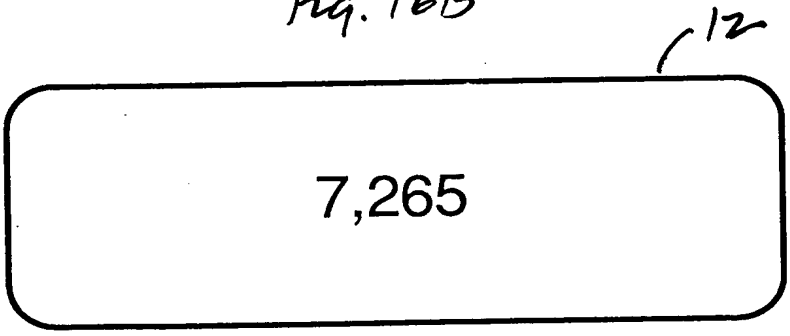

Fig. 16C

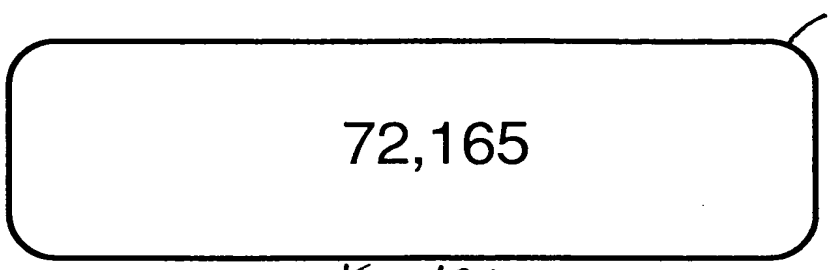

Fig. 17A

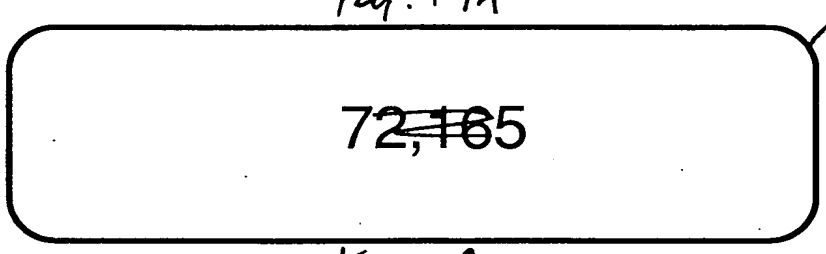

Fig. 17B

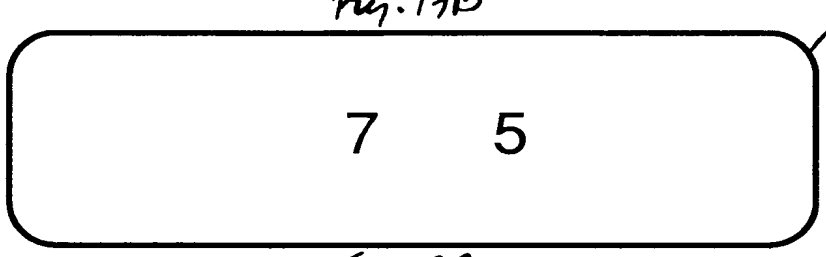

Fig. 17C

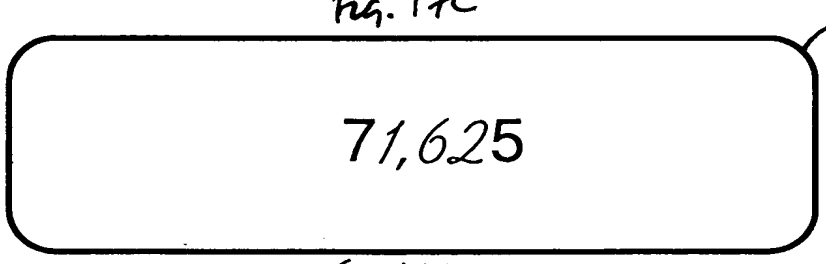

Fig. 17D

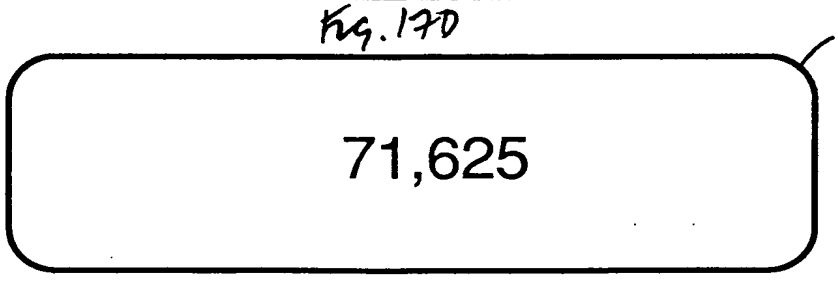

Fig. 17E

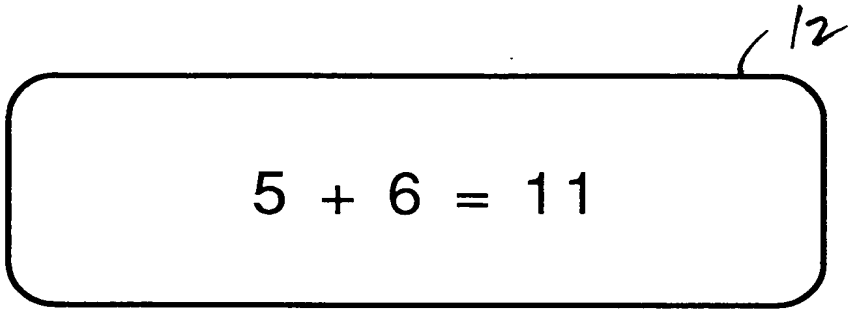

Fig. 18A

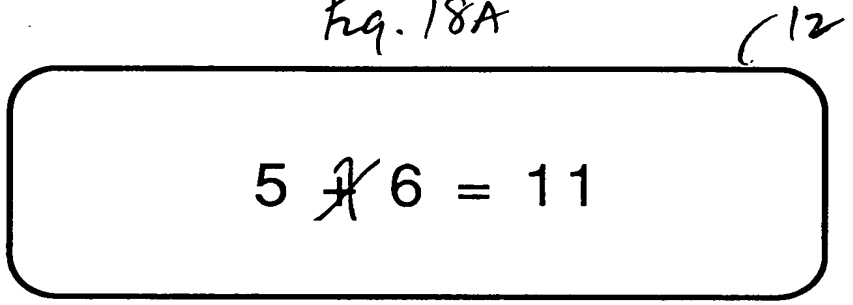

Fig. 18B

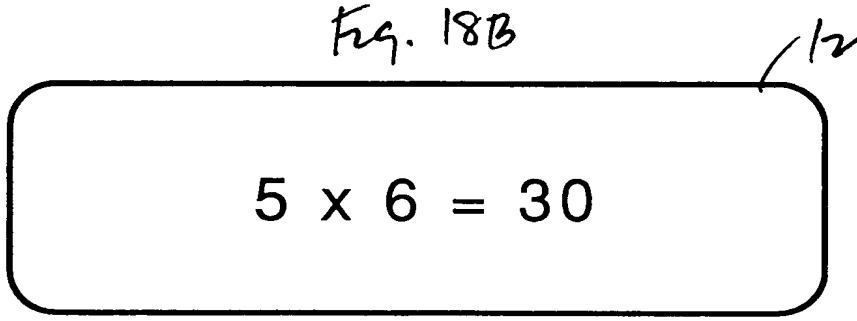

Fig. 18C

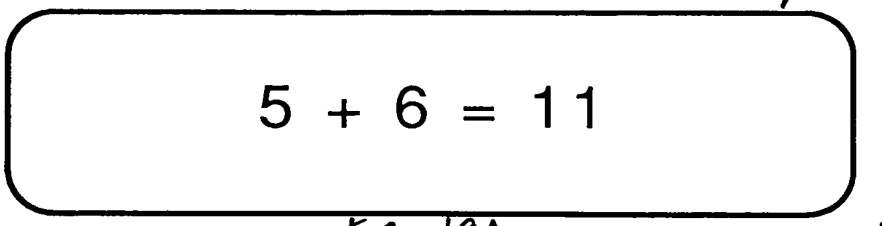

Fig. 19A

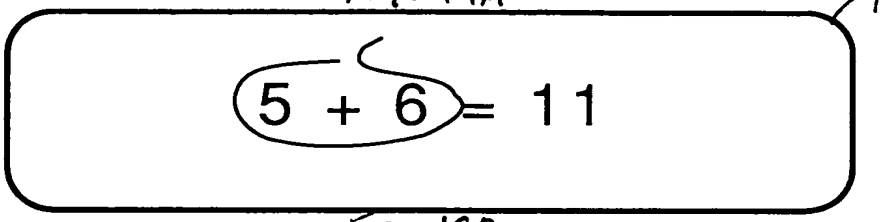

Fig. 19B

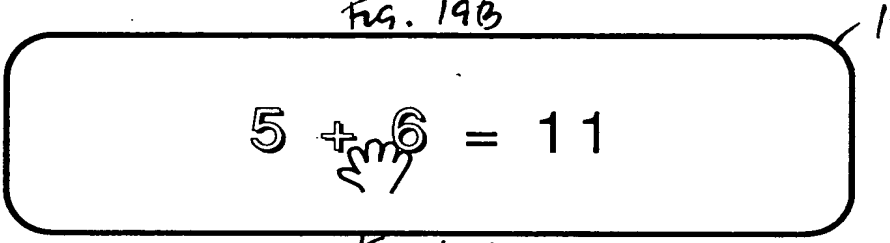

Fig. 19C

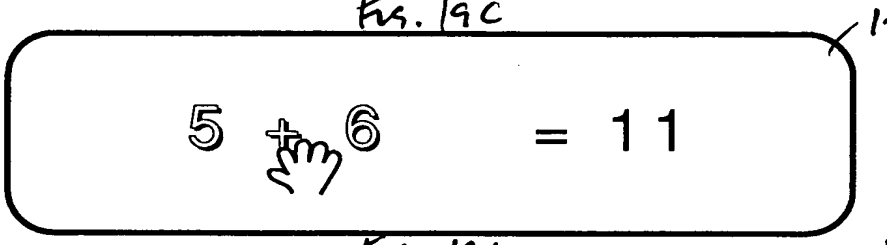

Fig. 19D

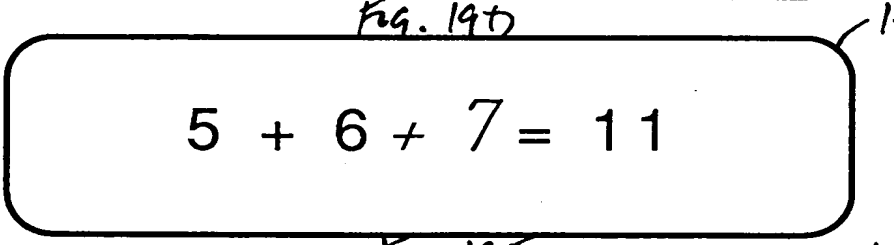

Fig. 19E

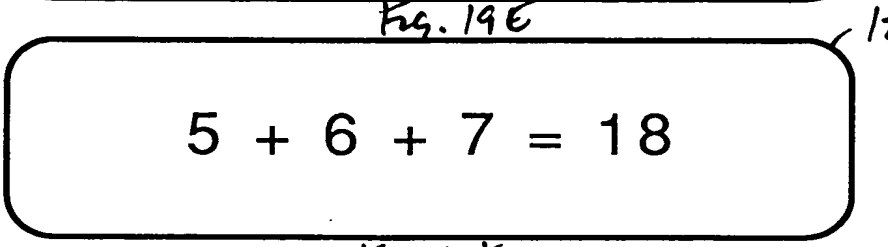

Fig. 19F

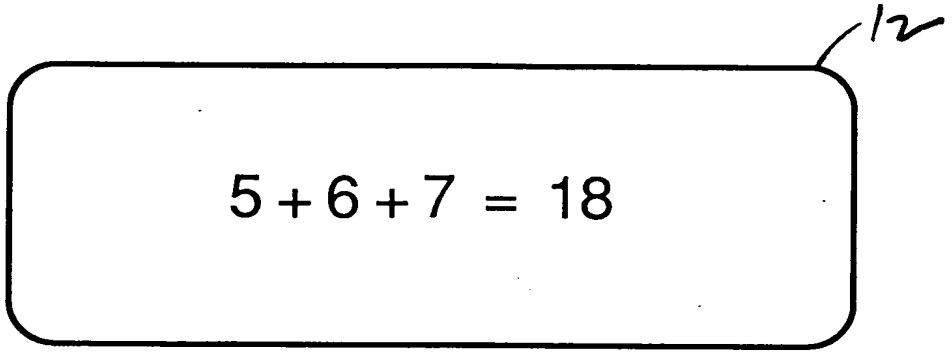

Fig. 20A

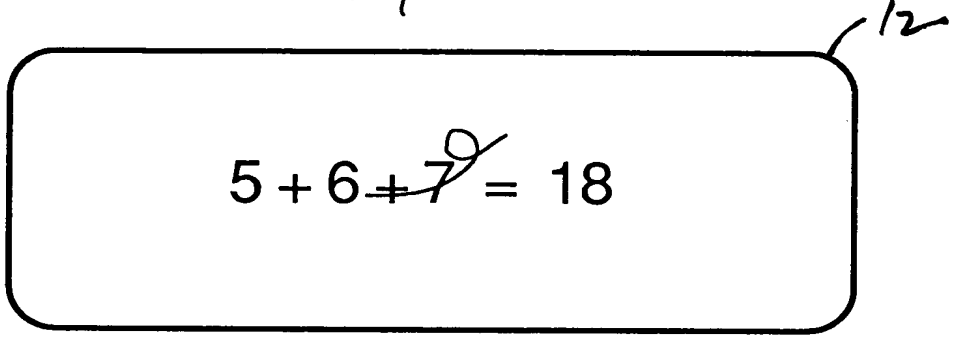

Fig. 20B

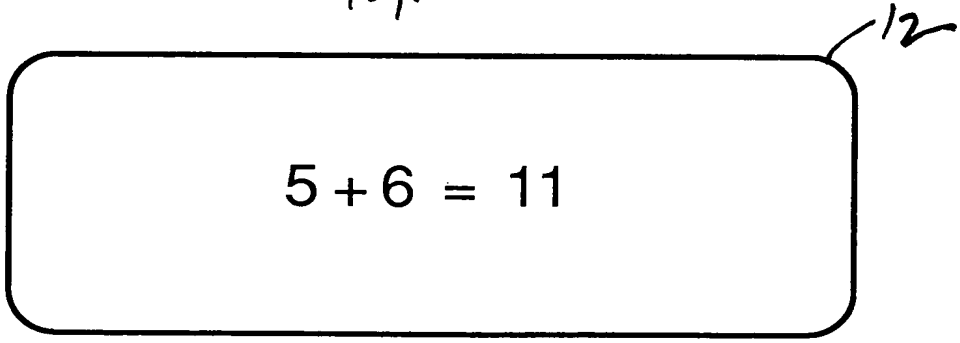

Fig. 20C

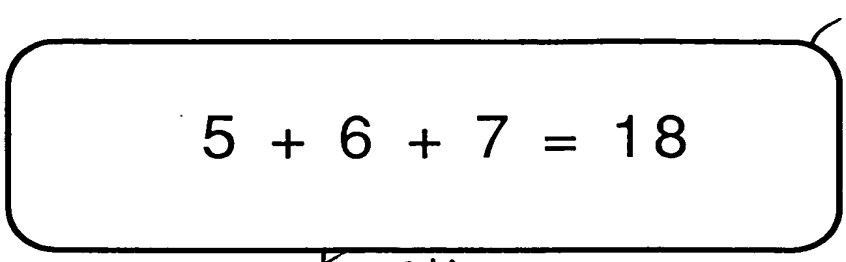

Fig. 21A

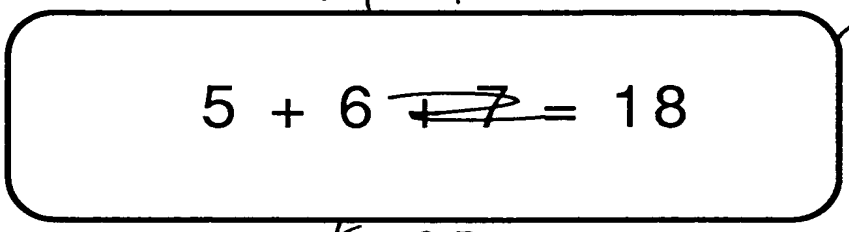

Fig. 21B

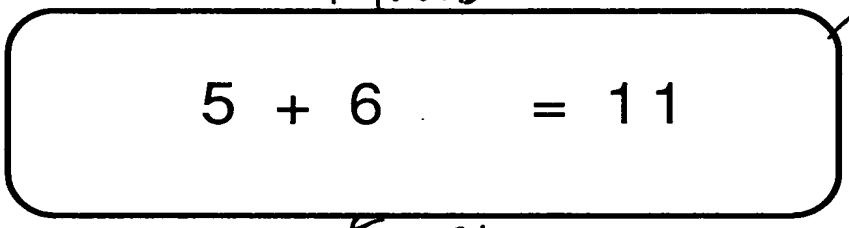

Fig. 21C

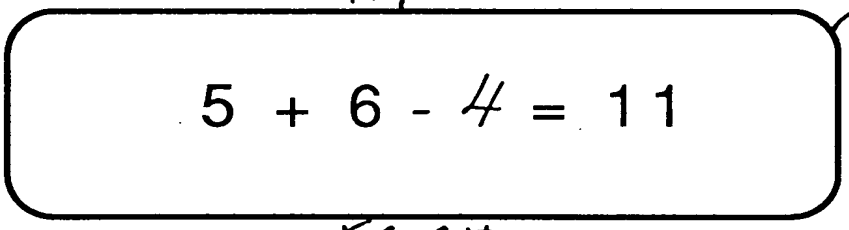

Fig. 21D

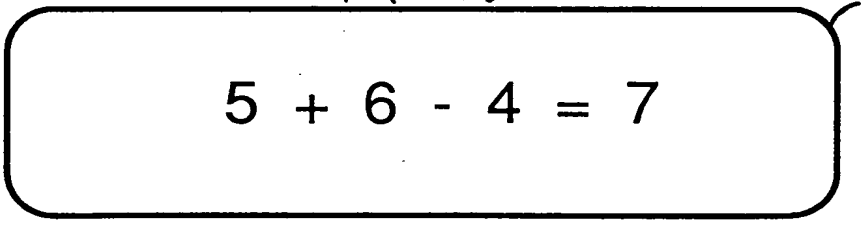

Fig. 21E

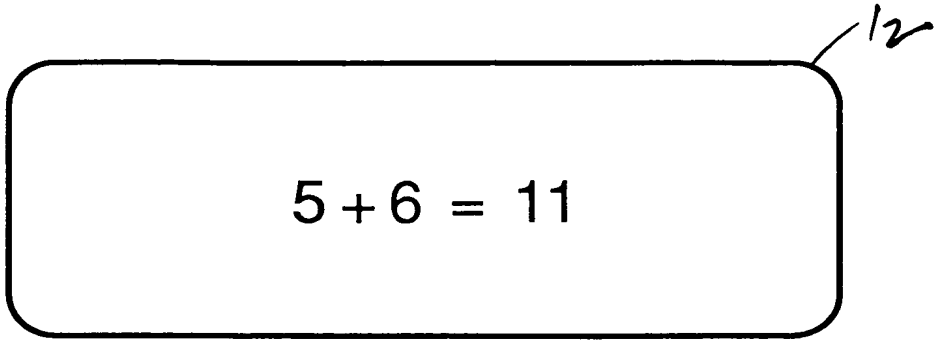

Fig. 22A

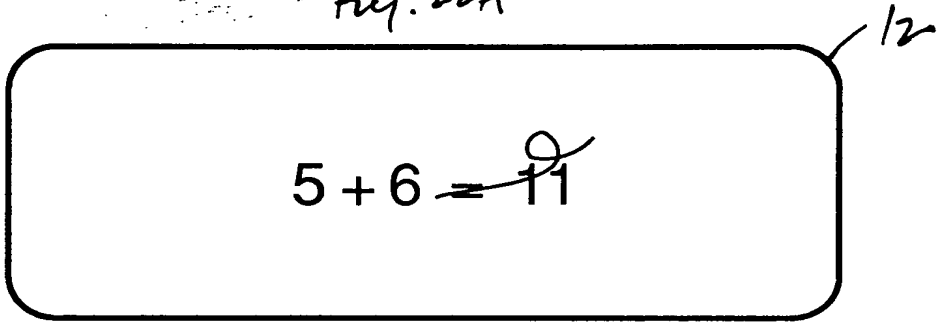

Fig. 22B

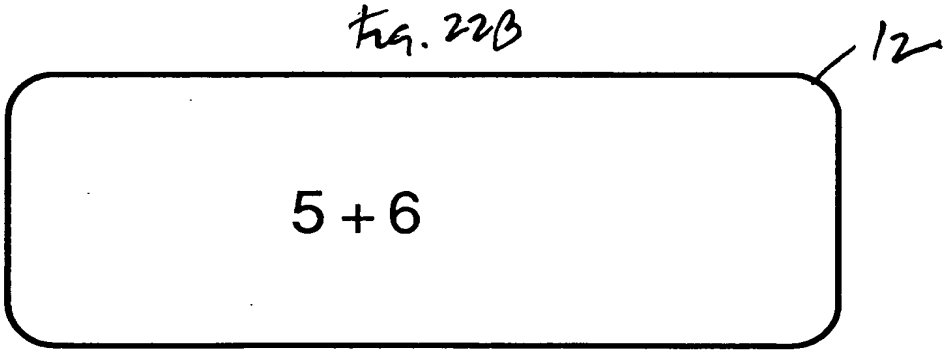

Fig. 22C

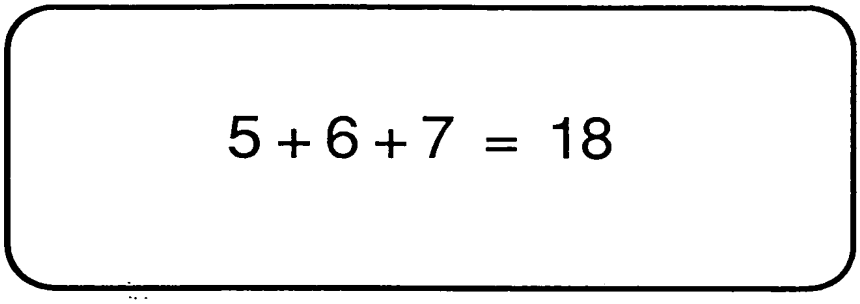

Fig. 23A

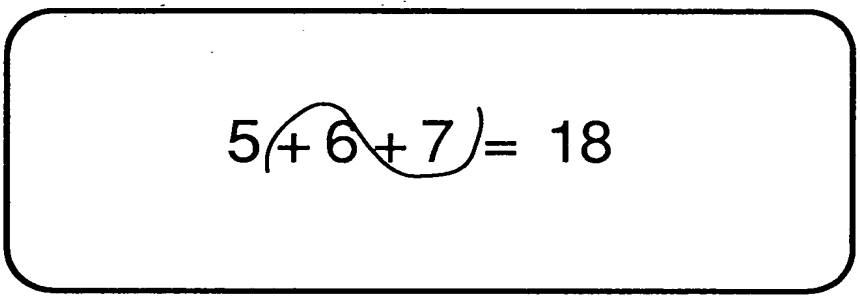

Fig. 23B

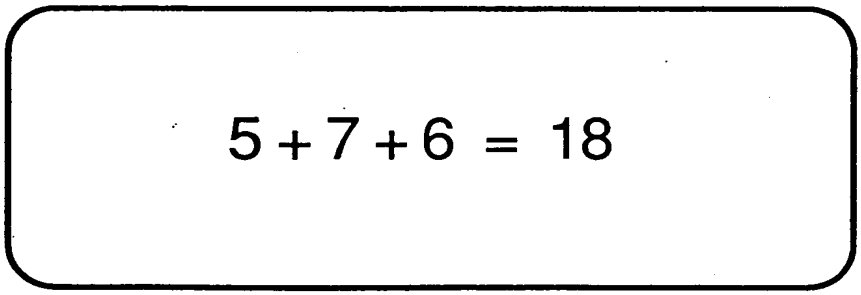

Fig. 23C

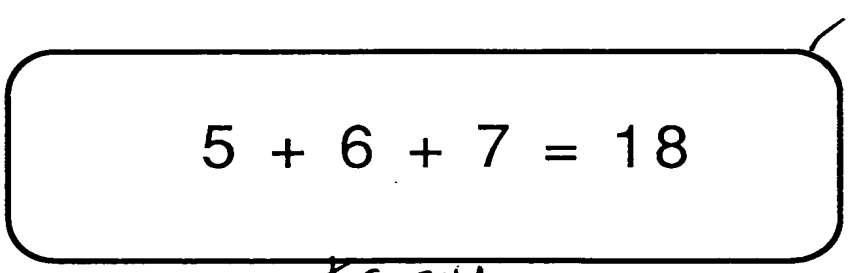

Fig. 24A

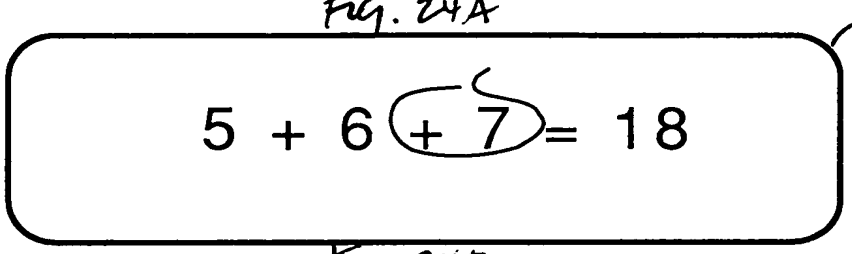

Fig. 24B

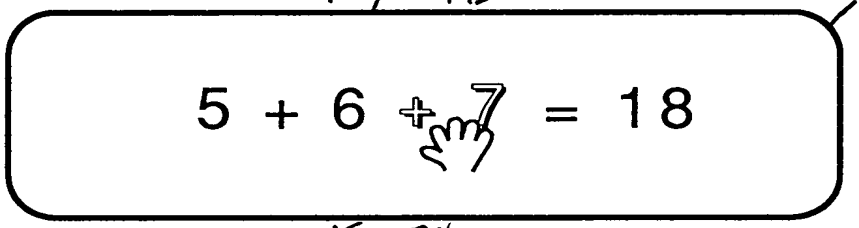

Fig. 24C

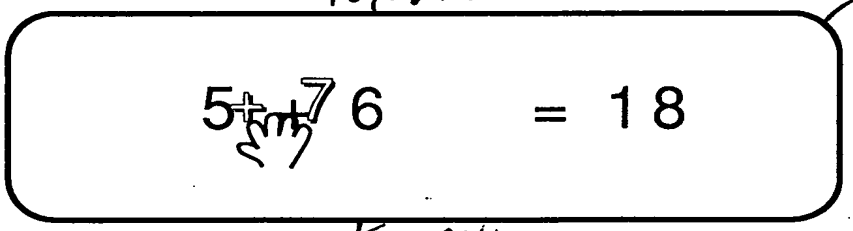

Fig. 24D

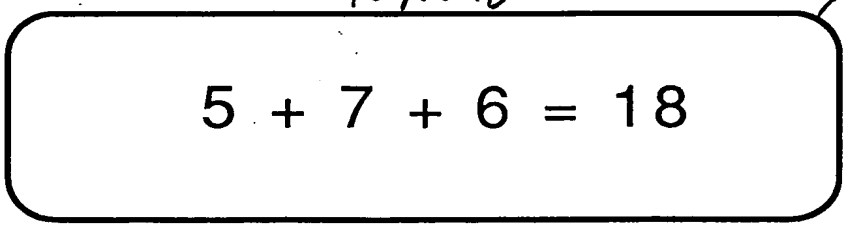

Fig. 24E

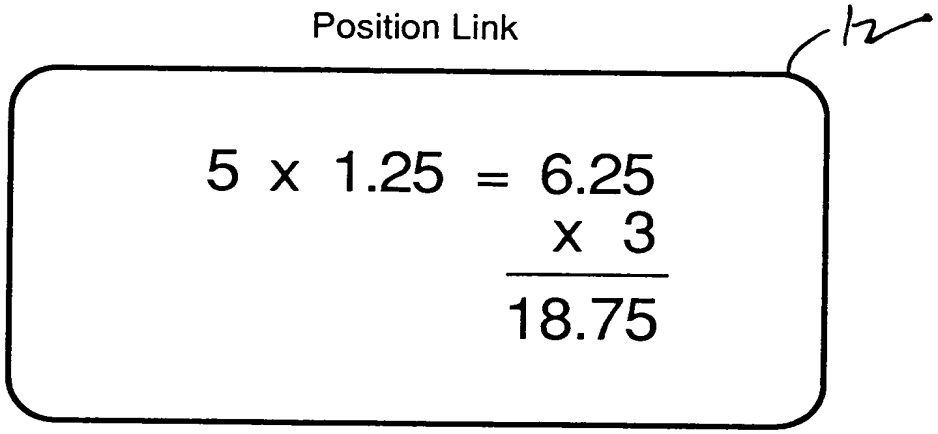

Fig. 25A

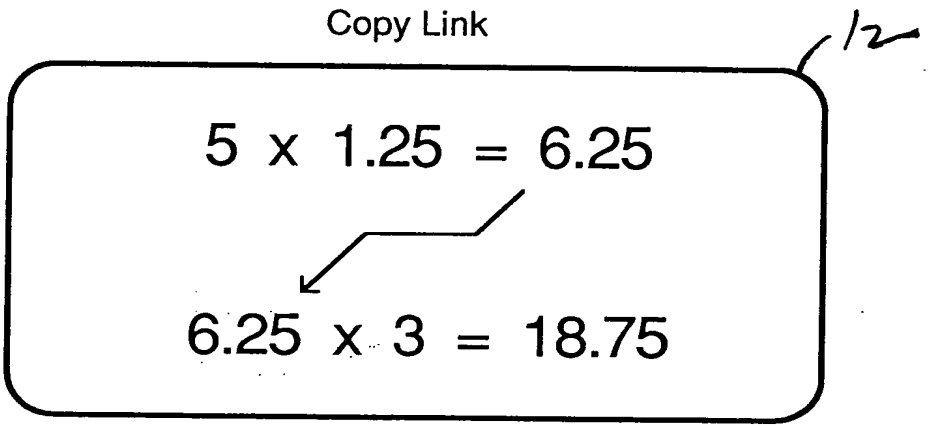

Fig. 25B

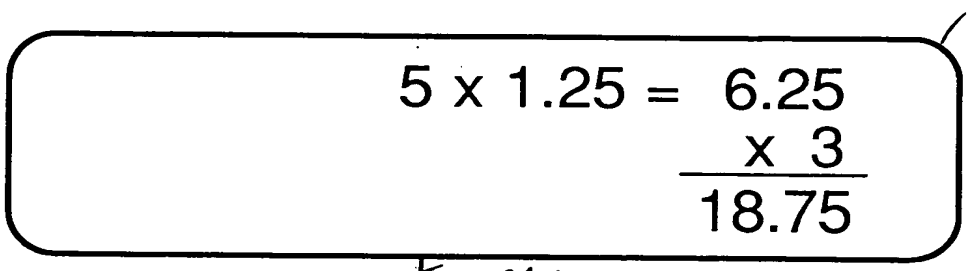

Fig. 26A

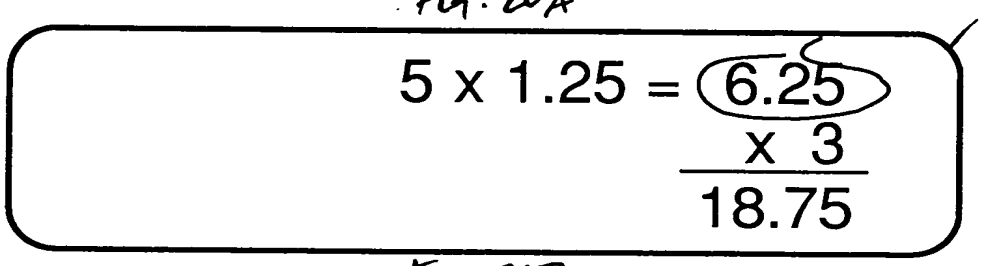

Fig. 26B

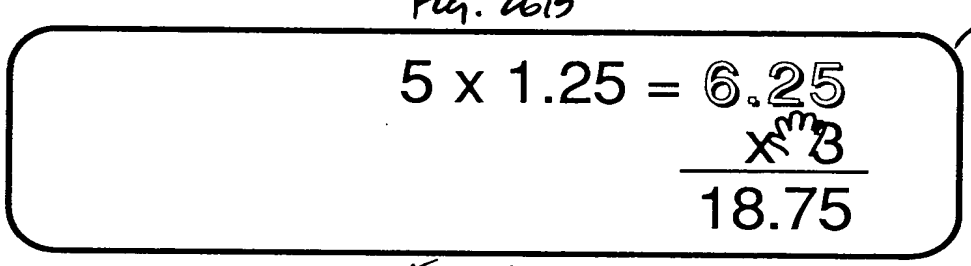

Fig. 26C

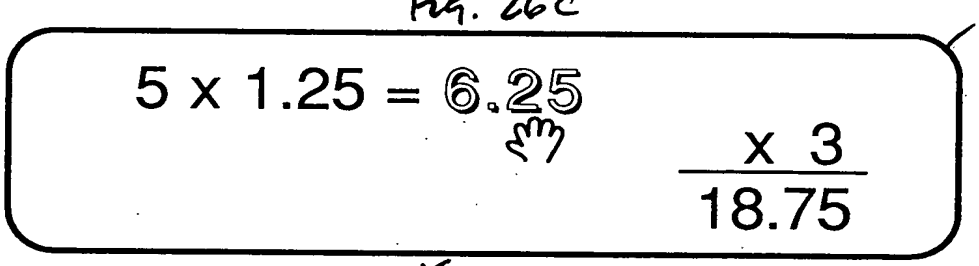

Fig. 26D

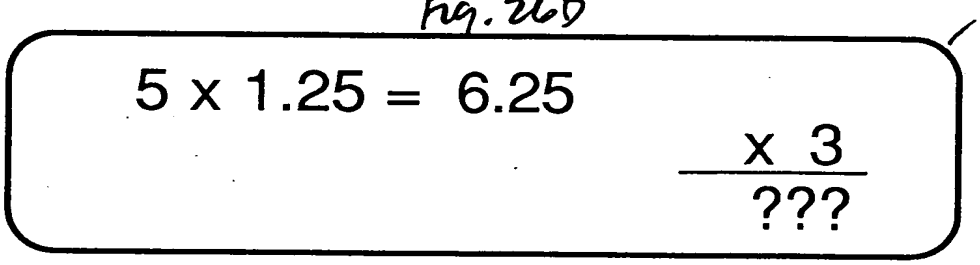

Fig. 26E

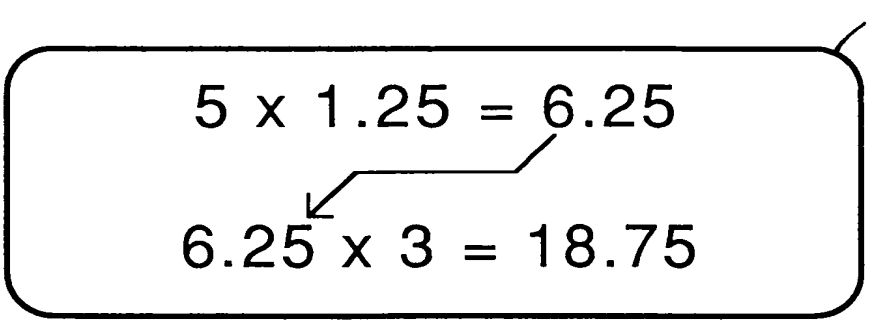

Fig. 27A

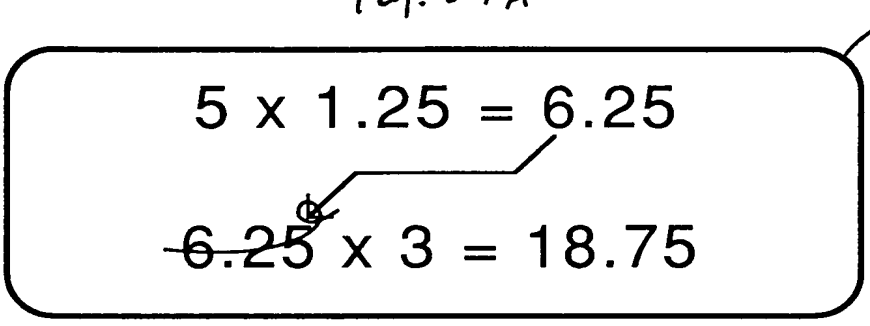

Fig. 27B

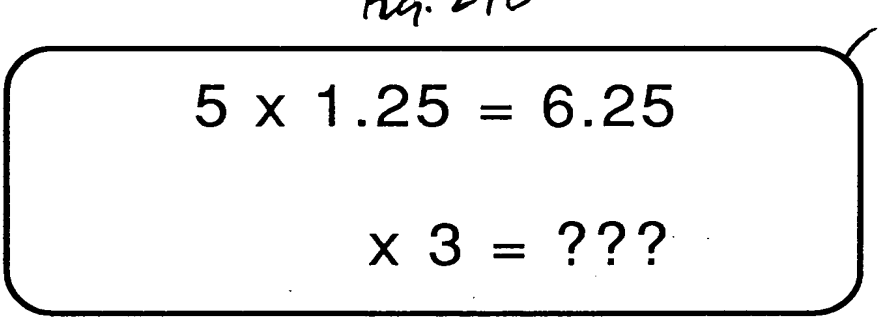

Fig. 27C

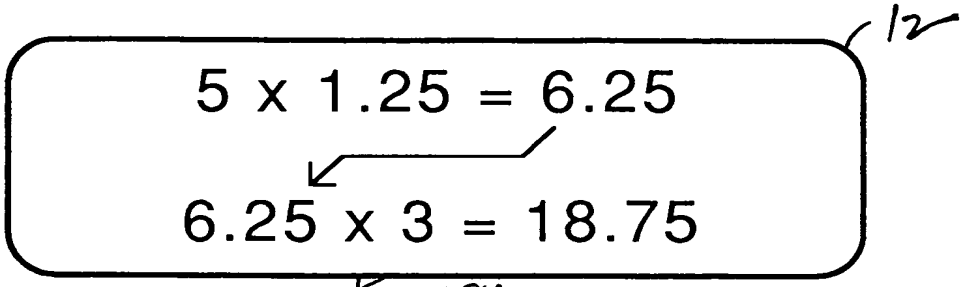

Fig. 28A

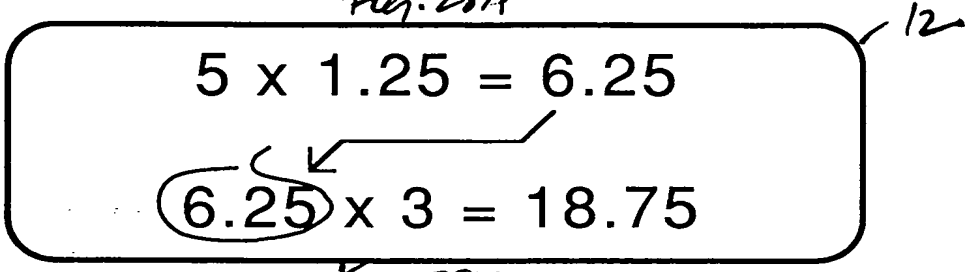

Fig. 28B

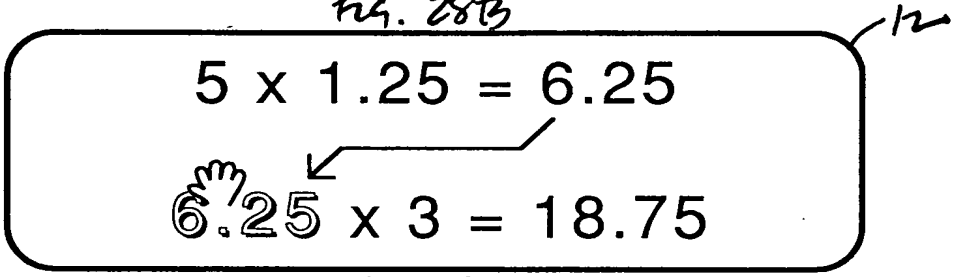

Fig. 28C

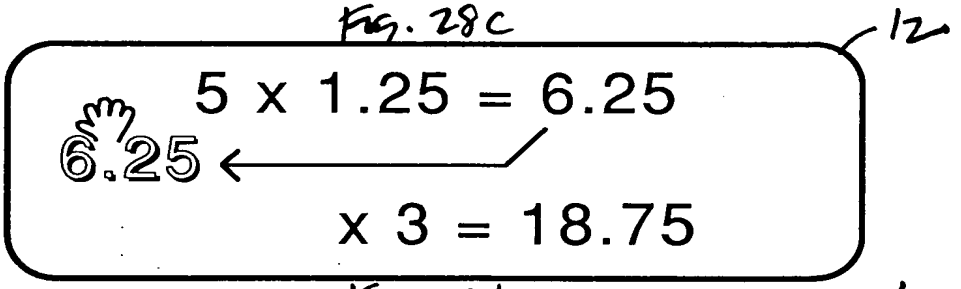

Fig. 28D

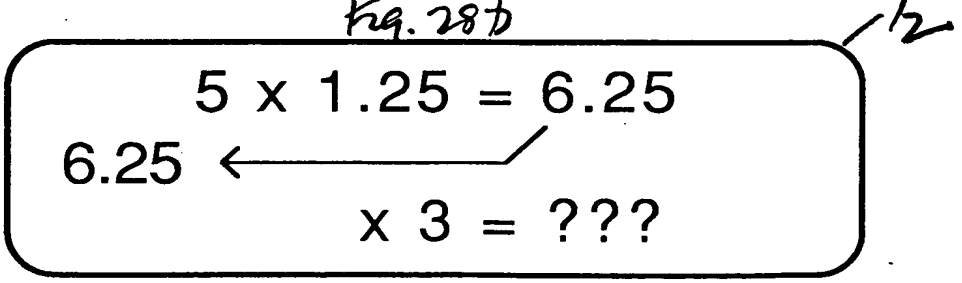

Fig. 28E

12

5 x 1.25 = 6.25

3.30
1.45
4.75

Fig. 29A

12

5 x 1.25 = 6.25

3.30
1.45
4.75

Fig. 29B

12

5 x 1.25 = 6.25

3.30
1.45
4.75

Fig. 29C

12

5 x 1.25 = 6.25

3.30
1.45
4.75

Fig. 29D

12

5 x 1.25 =

3.30
6.25
1.45
11.00

Fig. 29E

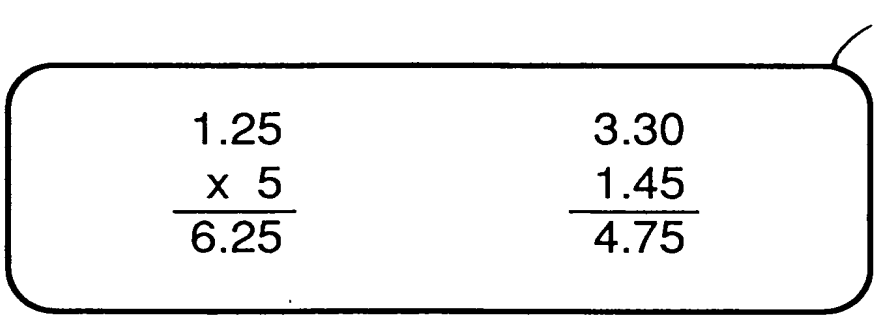

Fig. 30A

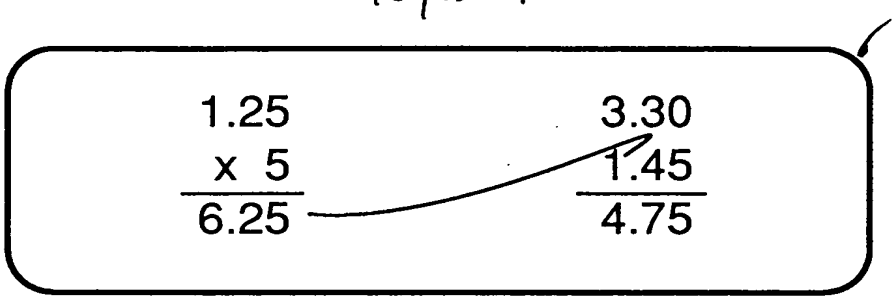

Fig. 30B

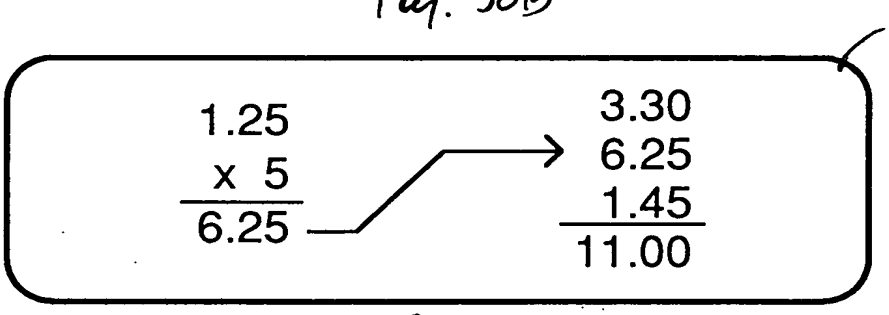

Fig. 30C

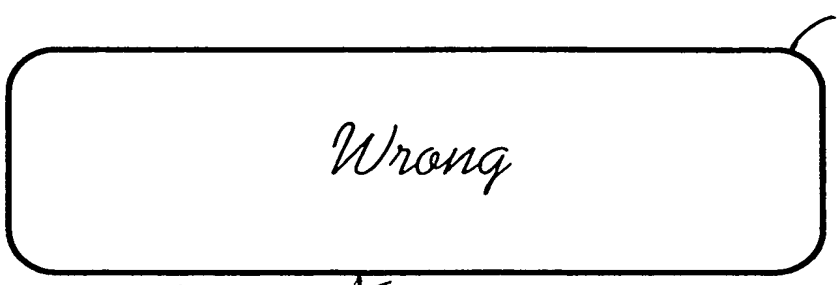

Fig. 31A

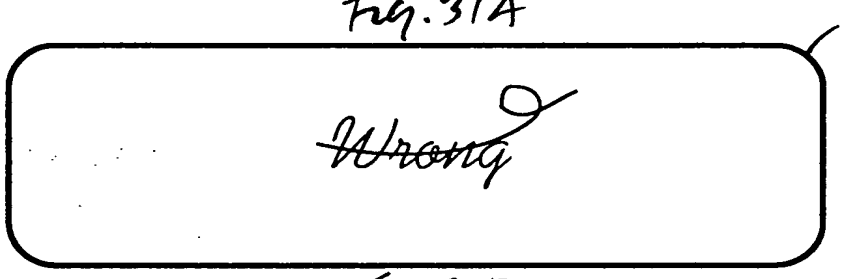

Fig. 31B

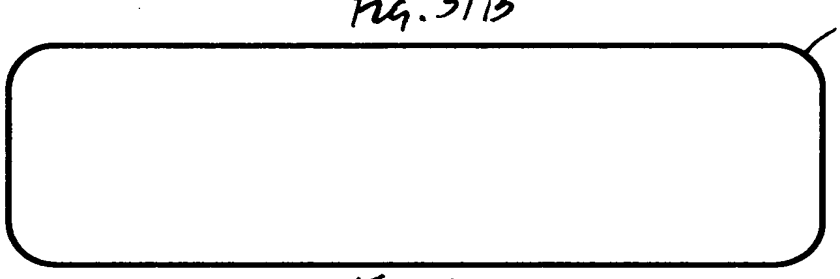

Fig. 31C

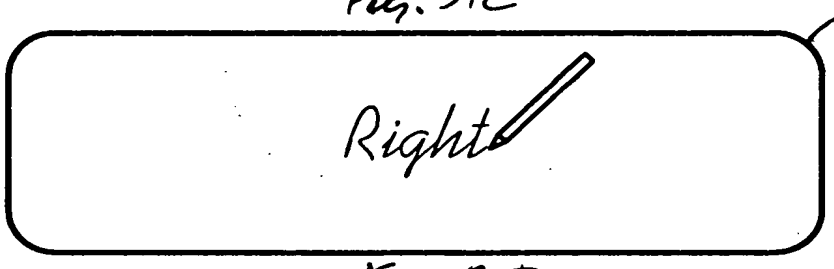

Fig. 31D

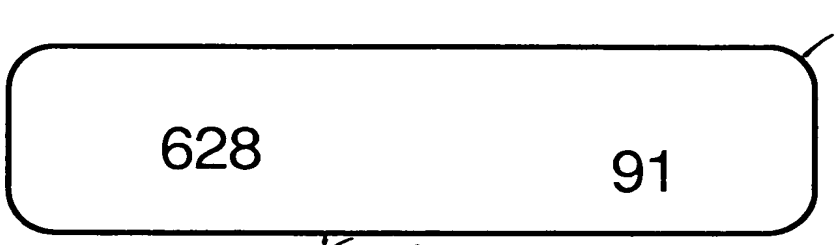

Fig. 32A

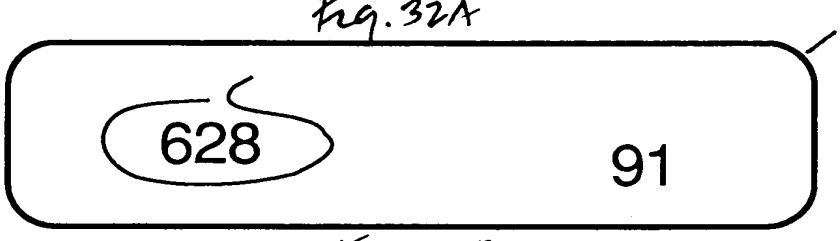

Fig. 32B

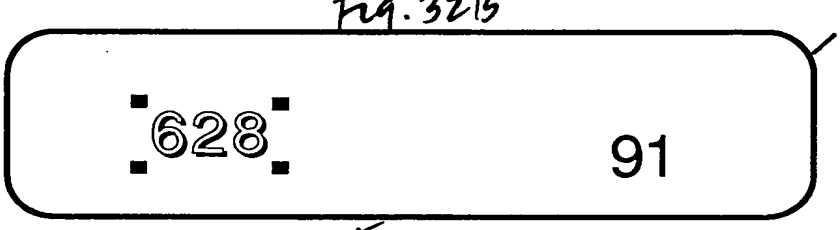

Fig. 32C

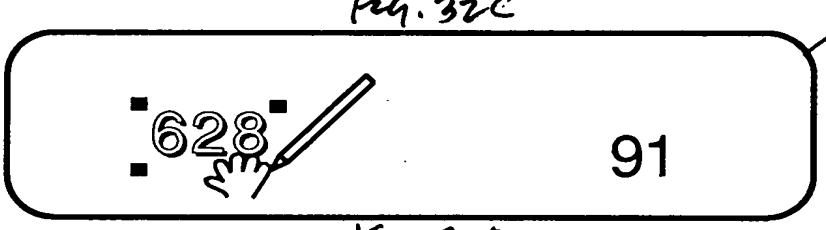

Fig. 32D

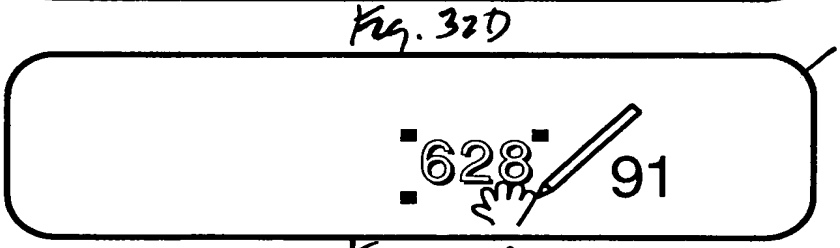

Fig. 32E

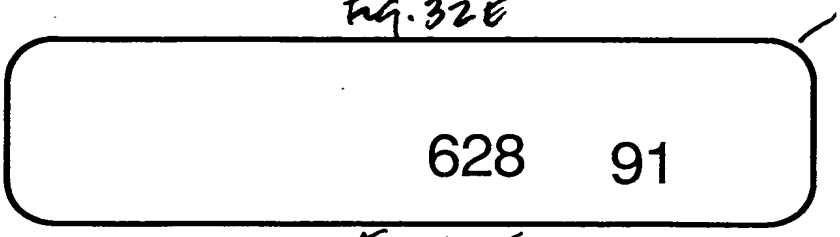

Fig. 32F

12

3.49
1.05
4.54 x 2 = 9.08
0.95 x 6 = 5.70
14.78 + 5% = 15.52

Fig. 33A

12

3.49
1.05
4.54 x 2 = 9.08
0.95 x 6 = 5.70
14.78 + 5% = 15.52

Fig. 33B

12

3.49
1.05
4.54 x 2 = 9.08
0.95 x 6 = 5.70
14.78 + 5% = 15.52

Fig. 33C

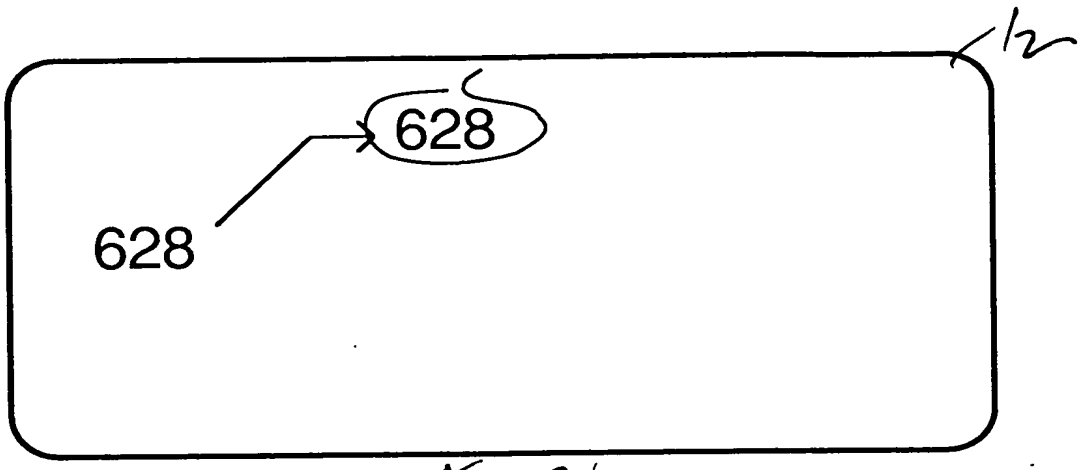

Fig. 34A

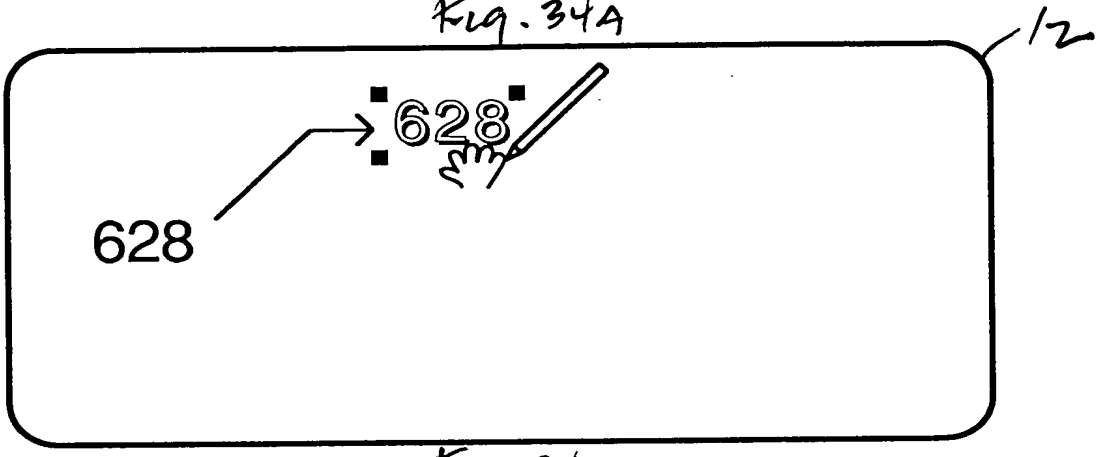

Fig. 34B

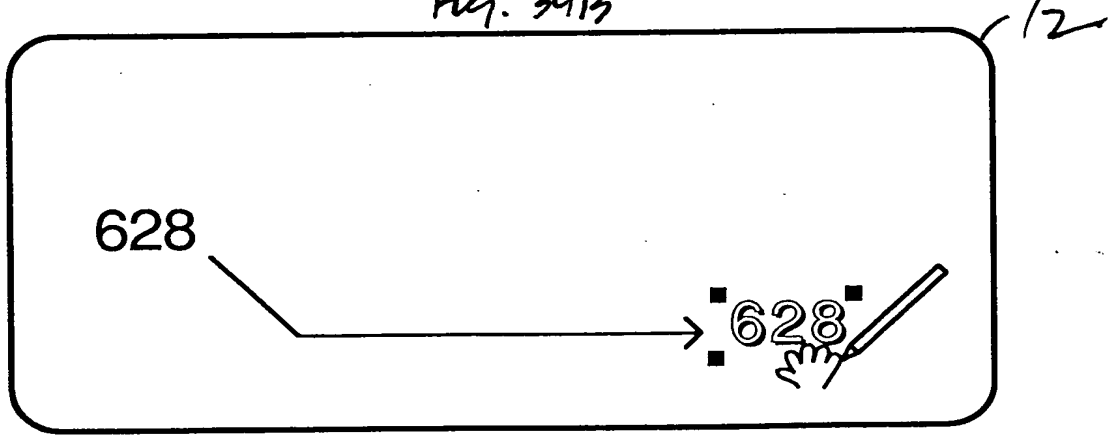

Fig. 34C

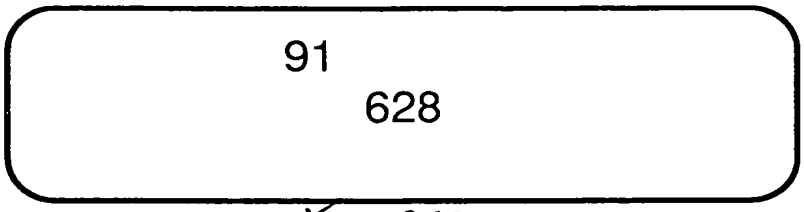

Fig. 35A

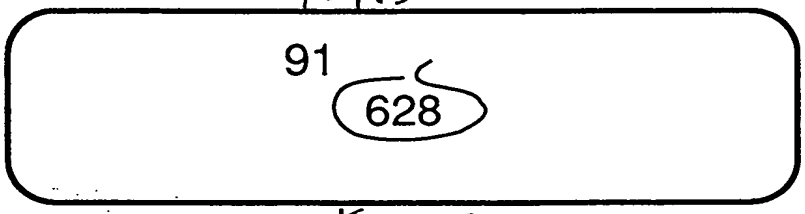

Fig. 35B

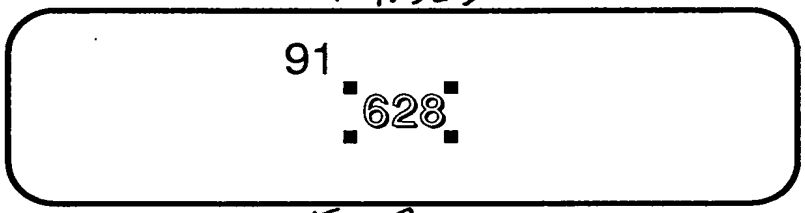

Fig. 35C

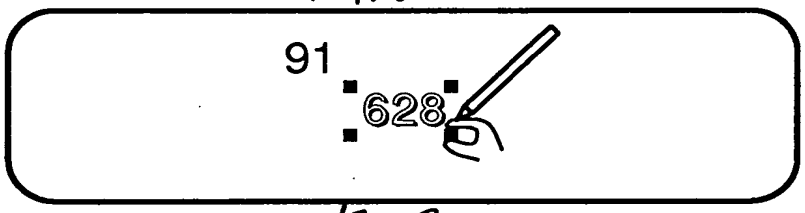

Fig. 35D

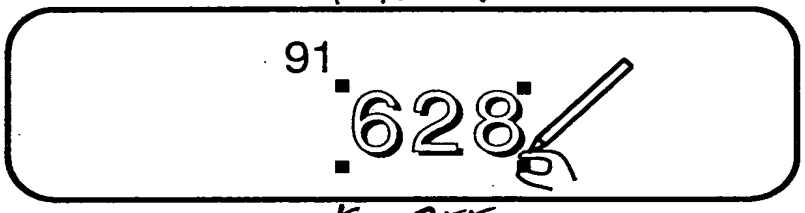

Fig. 35E

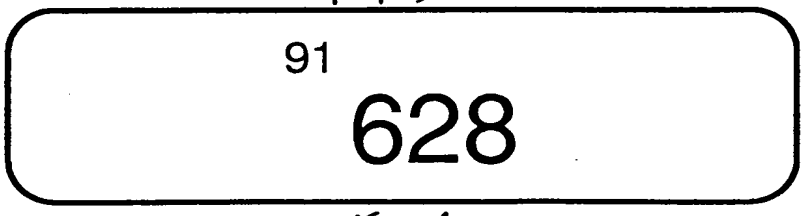

Fig. 35F

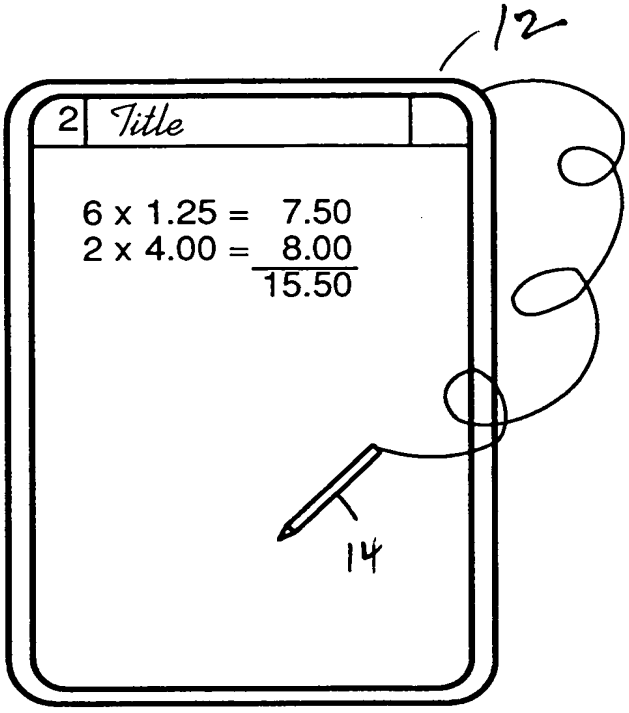

Fig. 36A

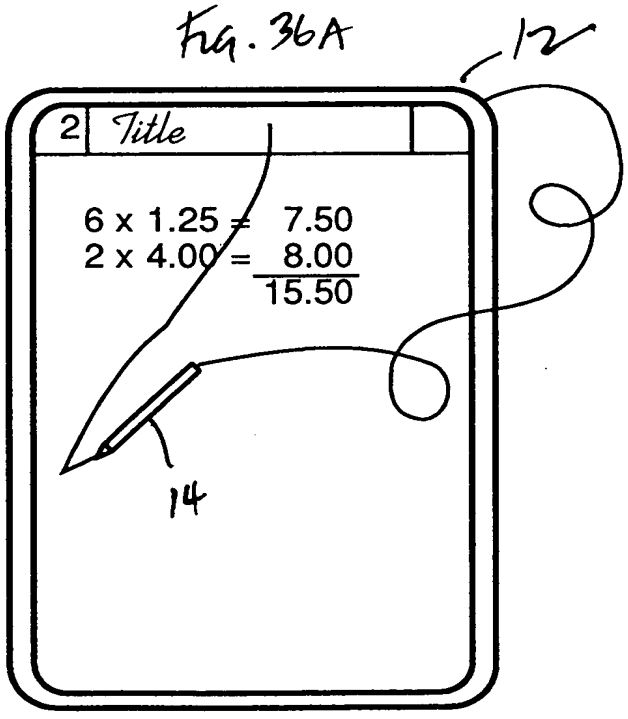

Fig. 36B

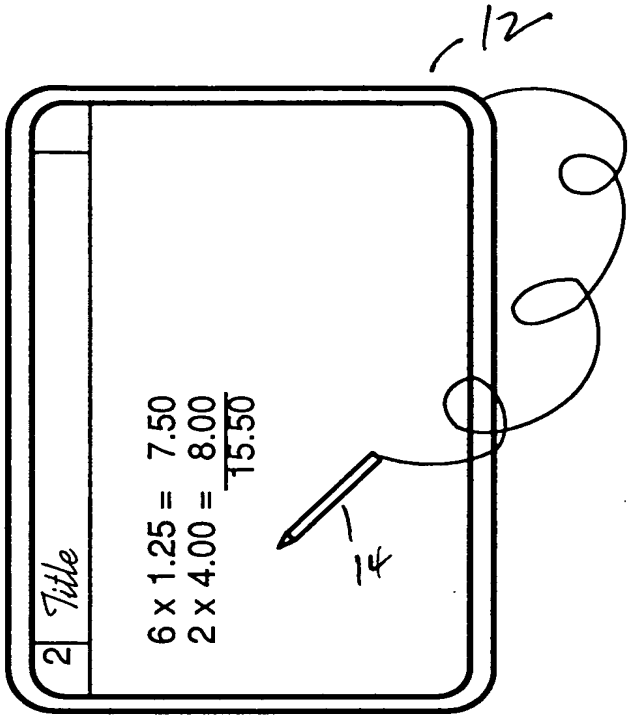

Fig. 36C

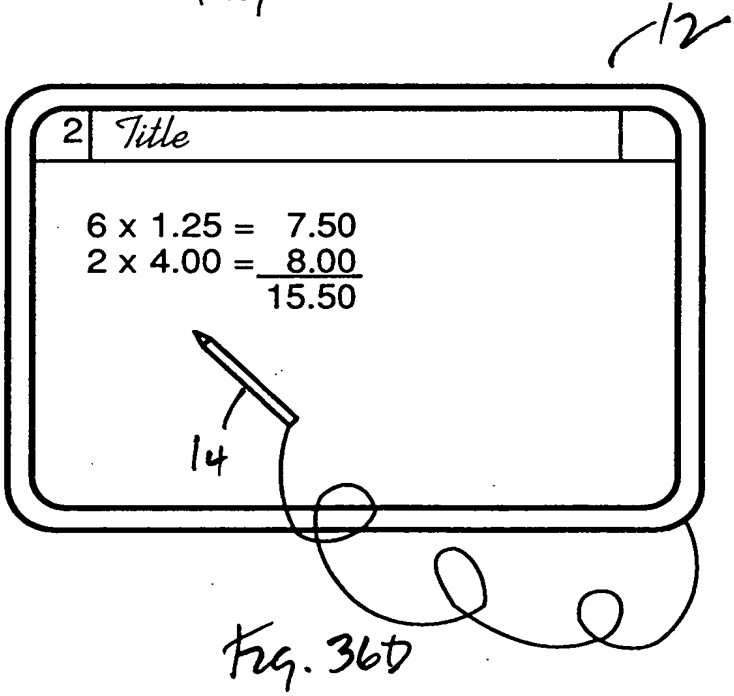

Fig. 36D

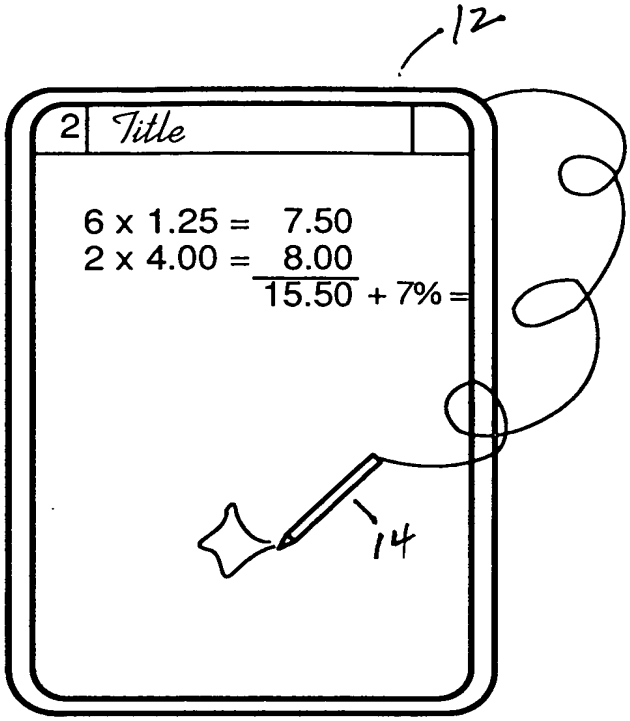

Fig. 37A

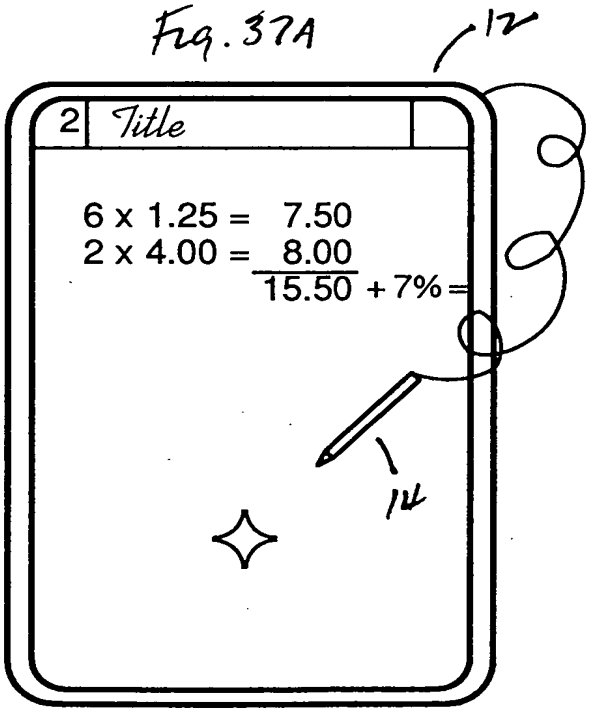

Fig. 37B

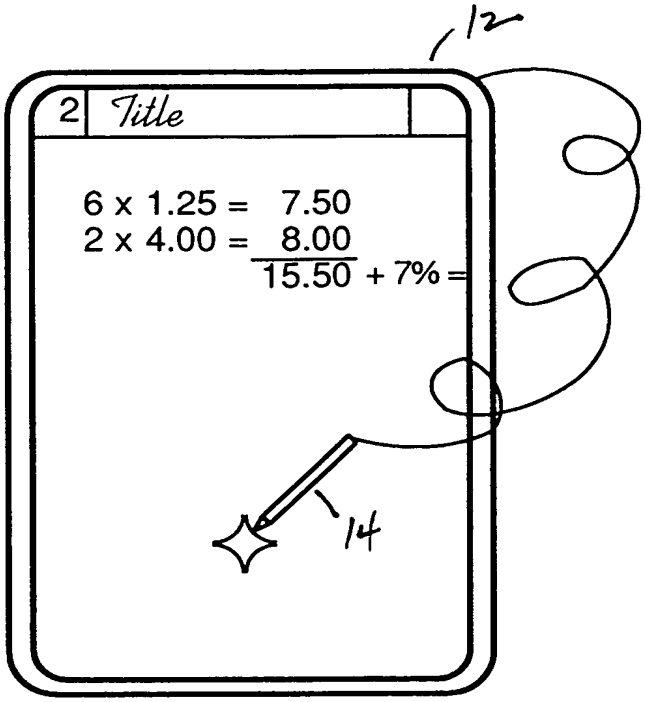

Fig. 37C

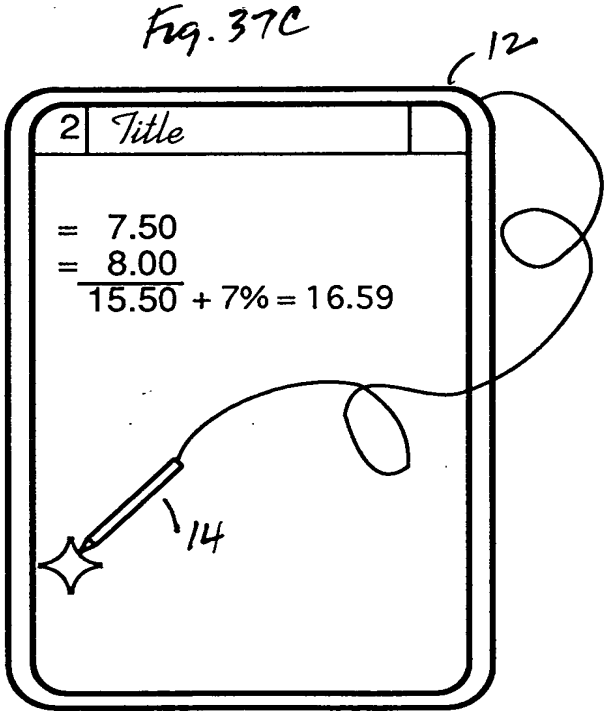

Fig. 37D

12

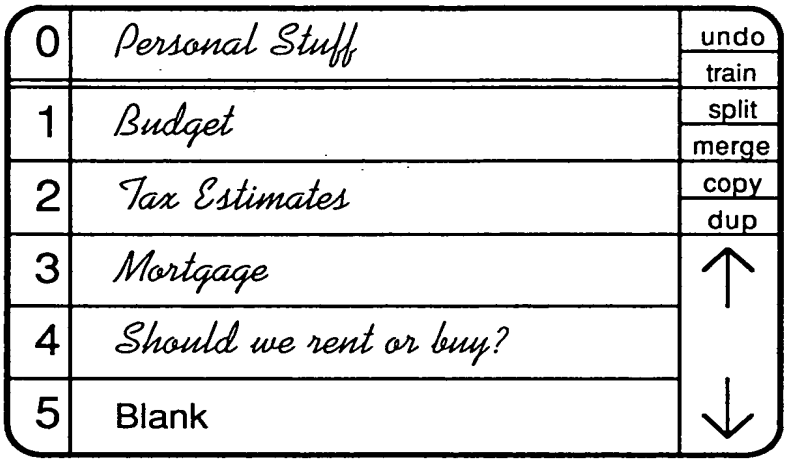
0
Personal Stuff
undo
train
1
Budget
split
merge
2
Tax Estimates
copy
dup
3
Mortgage
4
Should we rent or buy?
5
Blank

Fig. 38

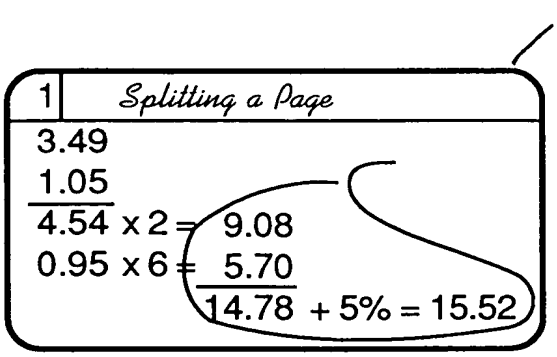

Fig. 39A

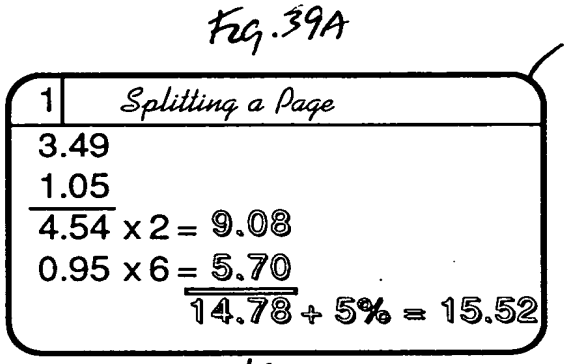

Fig. 39B

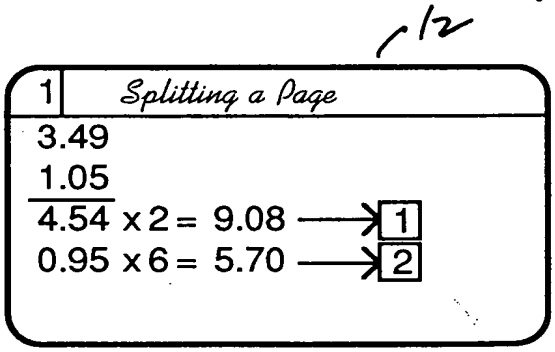

Fig. 39C

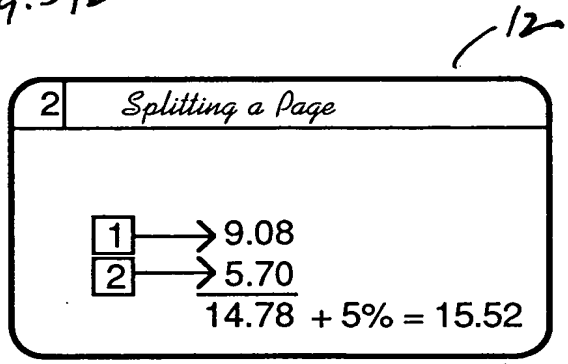

Fig. 39D

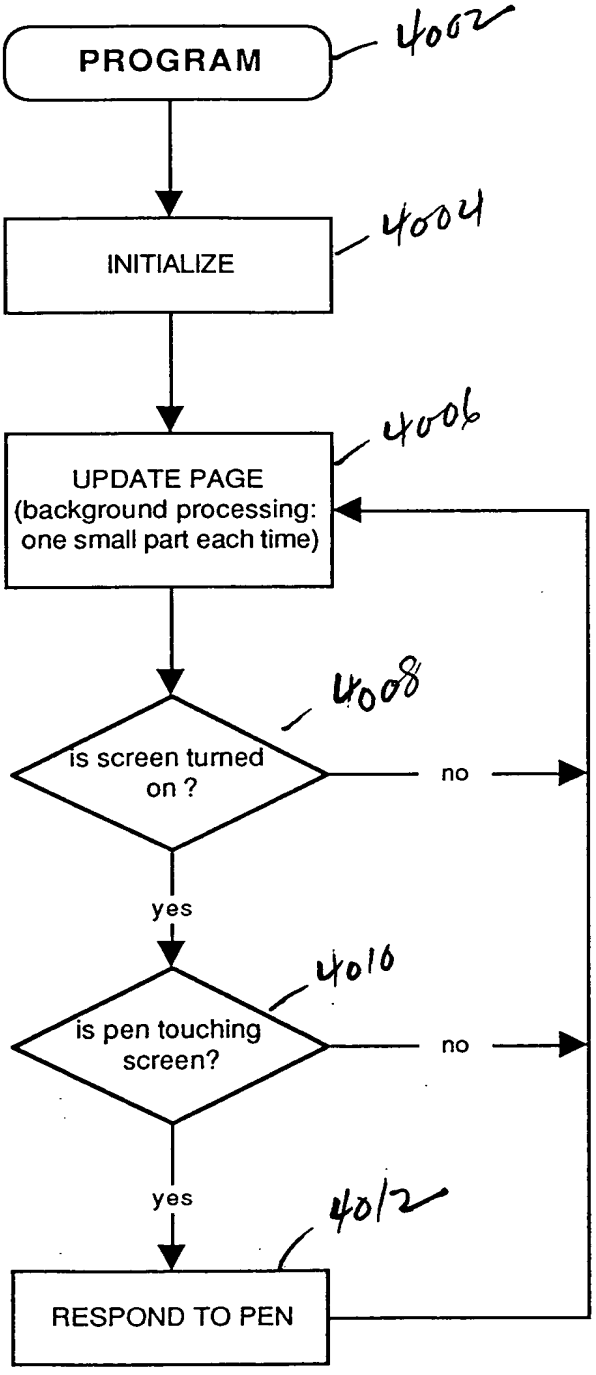
PROGRAM
4002
INITIALIZE
4004
UPDATE PAGE
(background processing:
one small part each time)
4006
is screen turned
on ?
4008
no
yes
is pen touching
screen?
4010
no
yes
RESPOND TO PEN
4012

Fig. 40

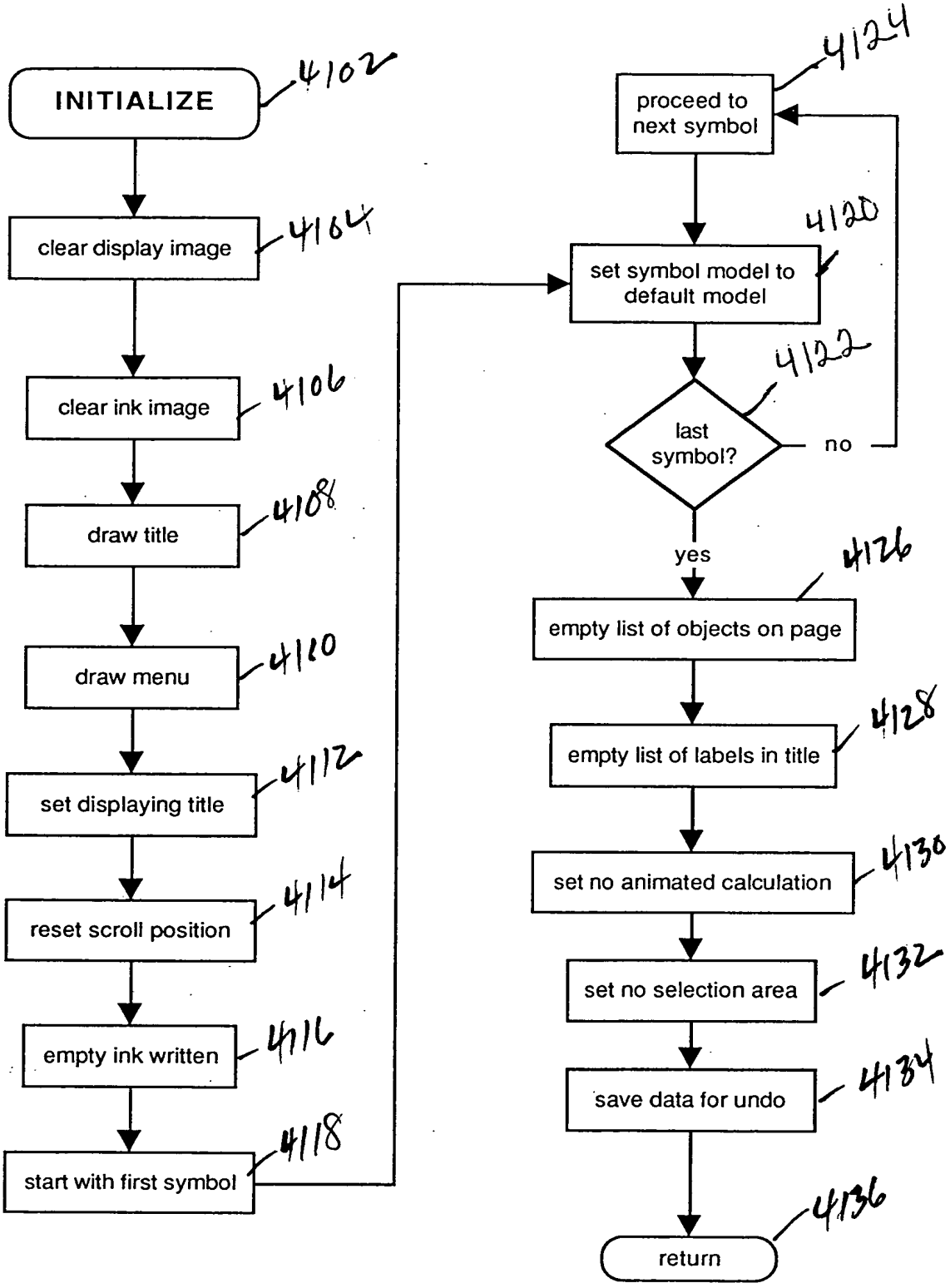
INITIALIZE
4102
clear display image
4104
clear ink image
4106
draw title
4108
draw menu
4110
set displaying title
4112
reset scroll position
4114
empty ink written
4116
start with first symbol
4118
proceed to next symbol
4124
set symbol model to default model
4120
last symbol?
4122
no
yes
empty list of objects on page
4126
empty list of labels in title
4128
set no animated calculation
4130
set no selection area
4132
save data for undo
4134
return
4136

Fig. 41

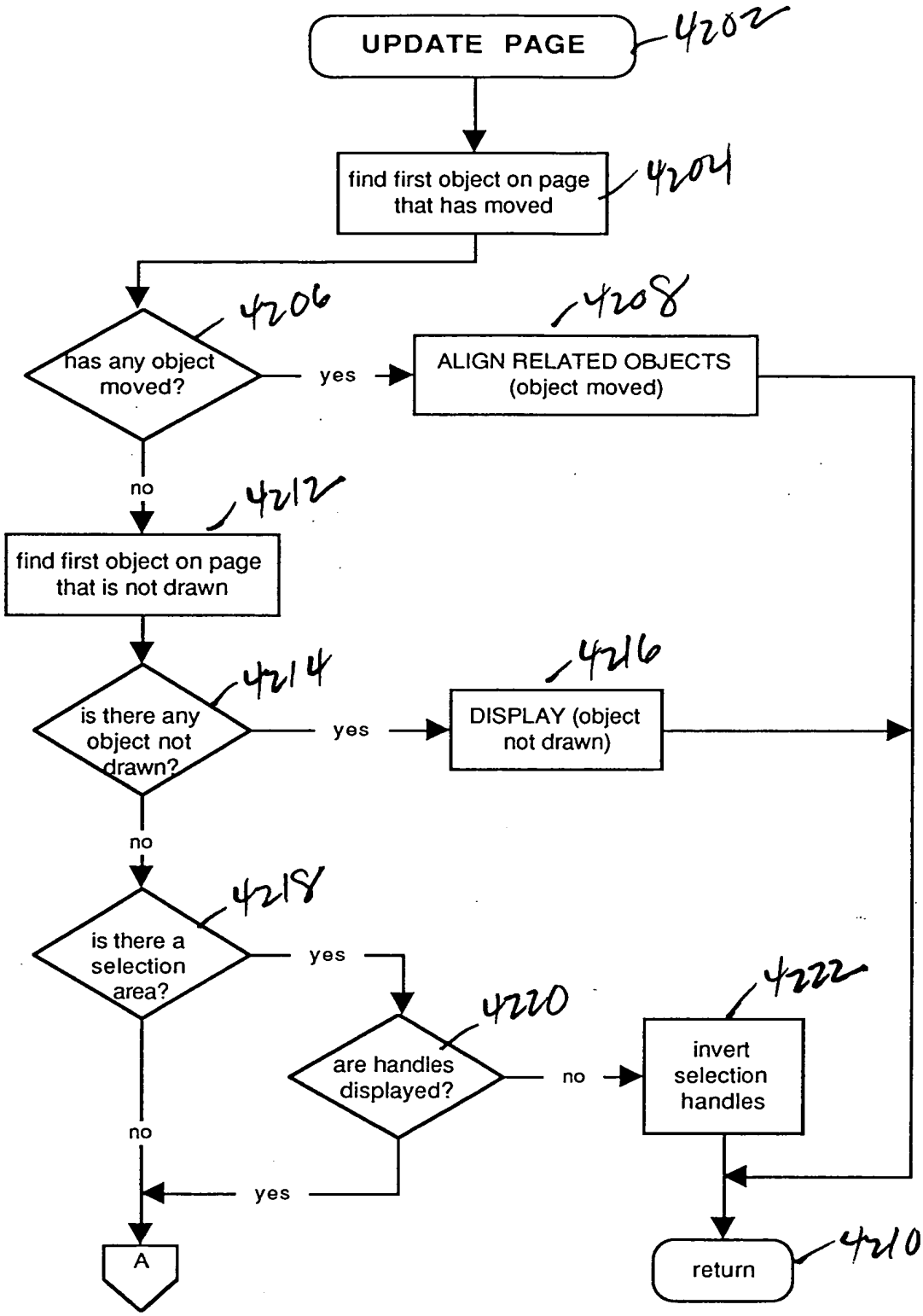
UPDATE PAGE
4202
find first object on page that has moved
4204
has any object moved?
4206
yes
ALIGN RELATED OBJECTS (object moved)
4208
no
find first object on page that is not drawn
4212
is there any object not drawn?
4214
yes
DISPLAY (object not drawn)
4216
no
is there a selection area?
4218
yes
are handles displayed?
4220
no
invert selection handles
4222
no
yes
A
return
4210

Fig. 42A

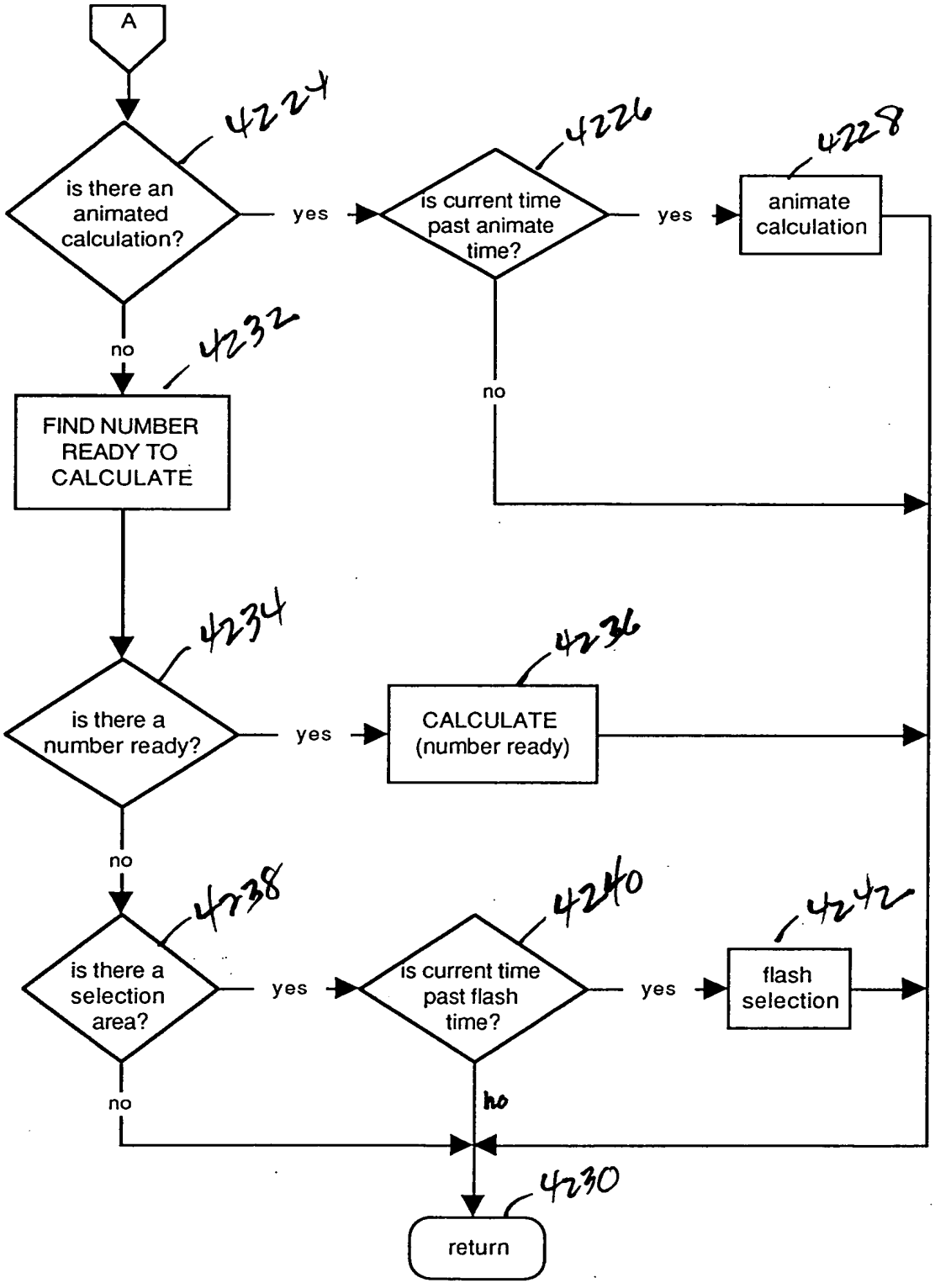
A
4224
is there an animated calculation?
yes
4226
is current time past animate time?
yes
4228
animate calculation
no
4232
FIND NUMBER READY TO CALCULATE
no
4234
is there a number ready?
yes
4236
CALCULATE (number ready)
no
4238
is there a selection area?
yes
4240
is current time past flash time?
yes
4242
flash selection
no
no
4230
return

Fig. 42B

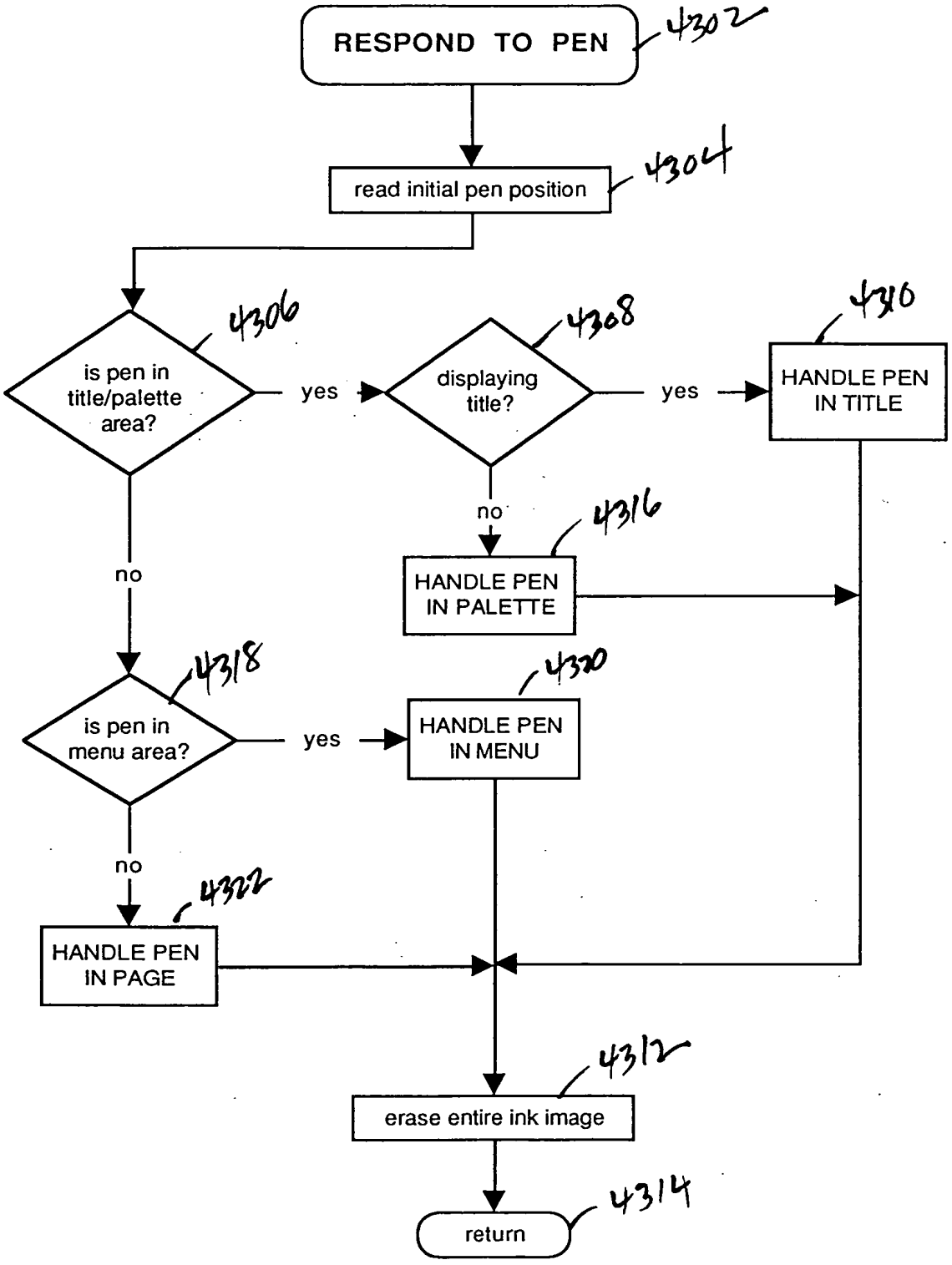
RESPOND TO PEN
4302
read initial pen position
4304
is pen in title/palette area?
4306
yes
displaying title?
4308
yes
HANDLE PEN IN TITLE
4310
no
HANDLE PEN IN PALETTE
4316
no
is pen in menu area?
4318
yes
HANDLE PEN IN MENU
4320
no
HANDLE PEN IN PAGE
4322
erase entire ink image
4312
return
4314

Fig. 43

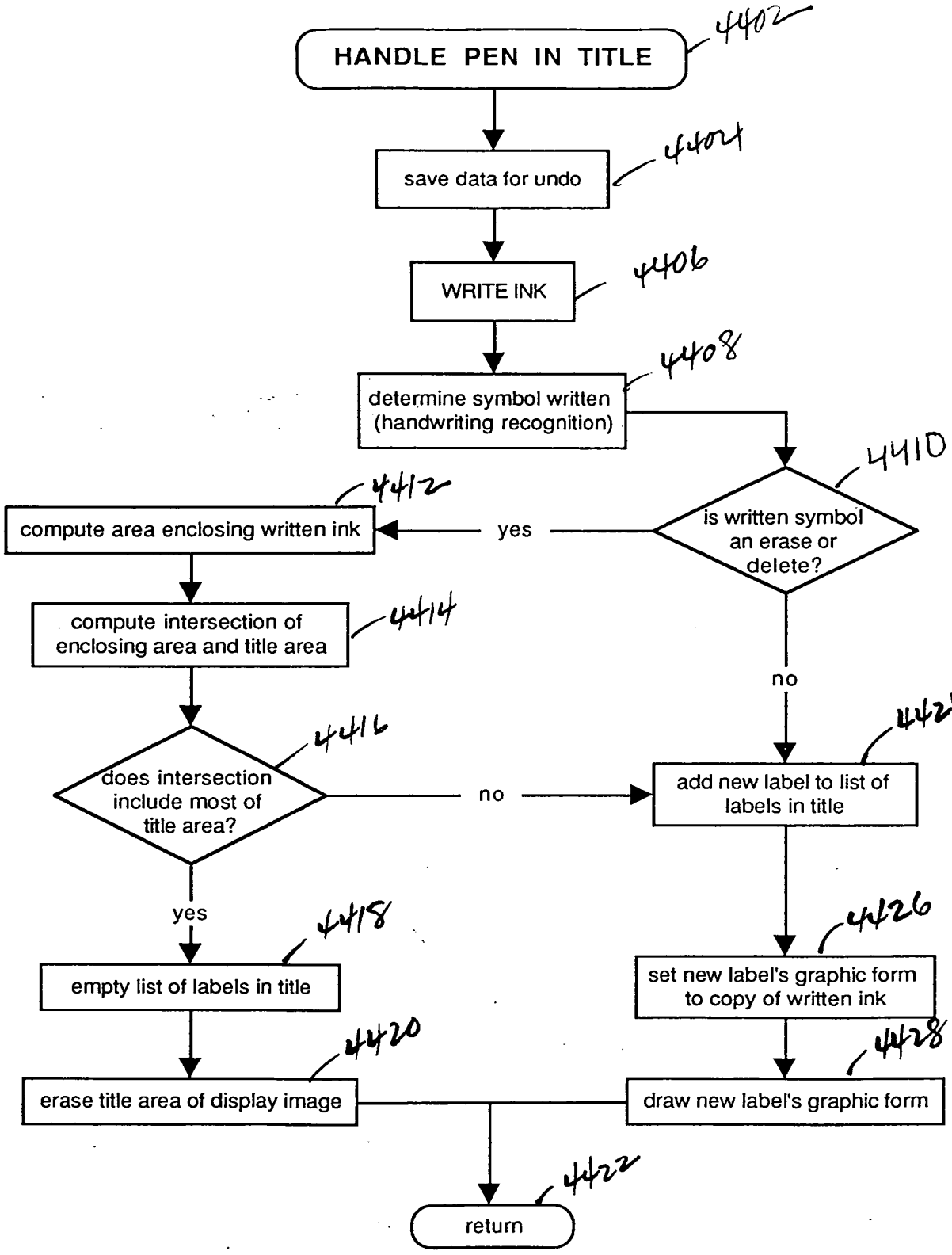
HANDLE PEN IN TITLE
4402
save data for undo
4404
WRITE INK
4406
determine symbol written (handwriting recognition)
4408
is written symbol an erase or delete?
4410
yes
compute area enclosing written ink
4412
compute intersection of enclosing area and title area
4414
does intersection include most of title area?
4416
no
add new label to list of labels in title
4424
yes
empty list of labels in title
4418
set new label's graphic form to copy of written ink
4426
erase title area of display image
4420
draw new label's graphic form
4428
return
4422

Fig. 44

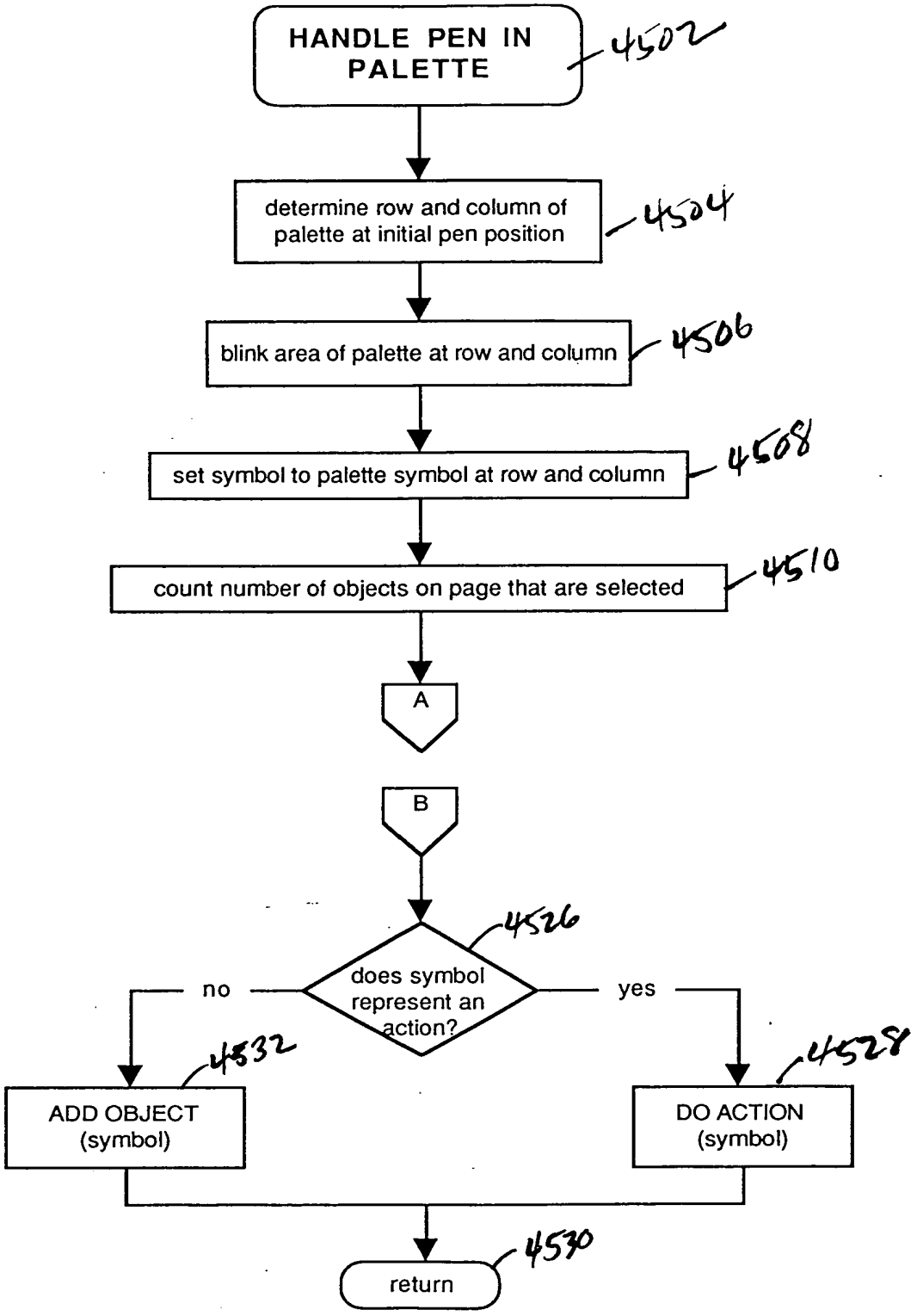
HANDLE PEN IN PALETTE
4502
determine row and column of palette at initial pen position
4504
blink area of palette at row and column
4506
set symbol to palette symbol at row and column
4508
count number of objects on page that are selected
4510
A
B
4526
does symbol represent an action?
no
yes
4532
ADD OBJECT (symbol)
4528
DO ACTION (symbol)
return
4530

Fig. 45A

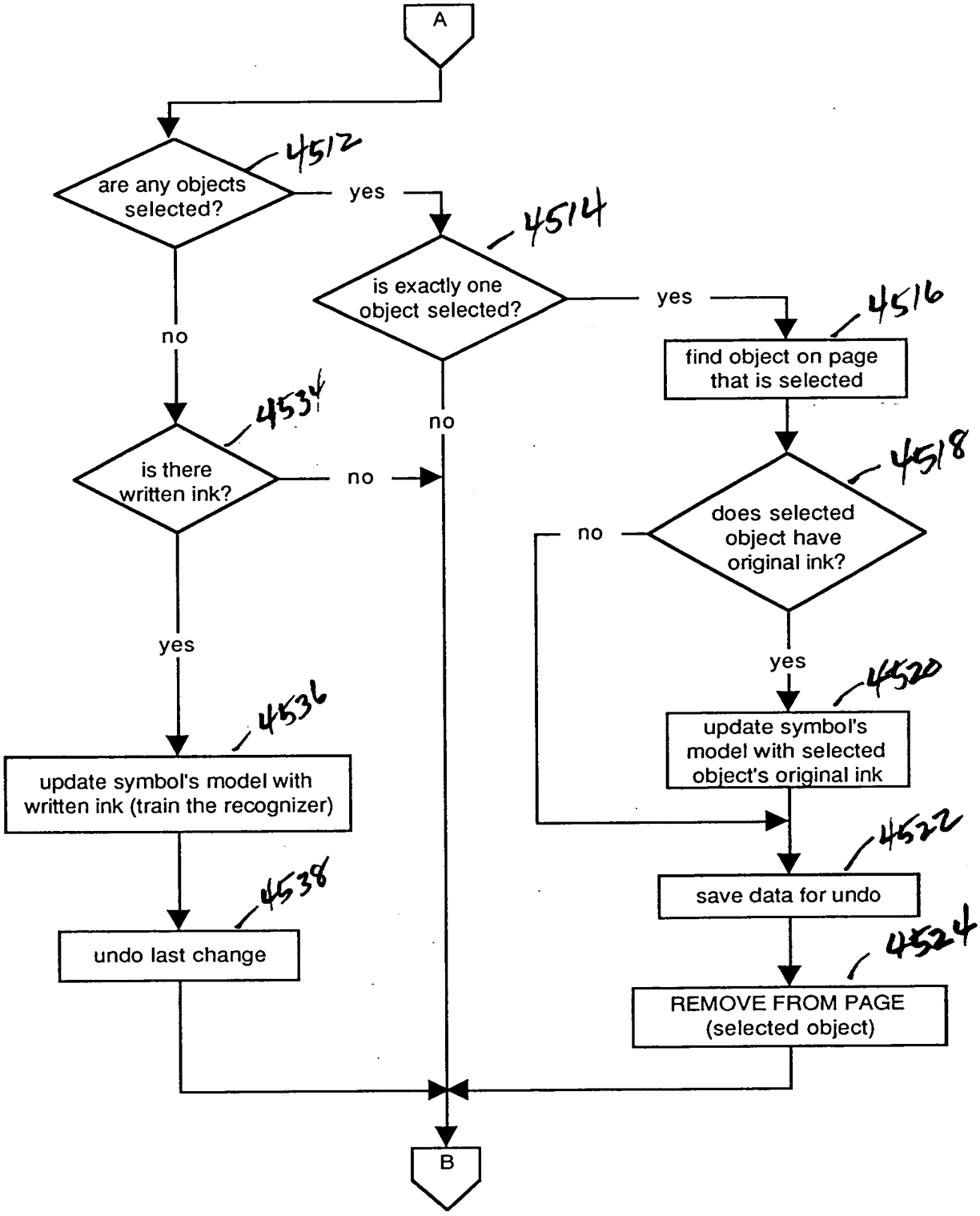
A
4512
are any objects selected?
yes
no
4514
is exactly one object selected?
yes
no
4516
find object on page that is selected
4518
does selected object have original ink?
no
yes
4520
update symbol's model with selected object's original ink
4522
save data for undo
4524
REMOVE FROM PAGE (selected object)
4534
is there written ink?
no
yes
4536
update symbol's model with written ink (train the recognizer)
4538
undo last change
B

Fig. 45B

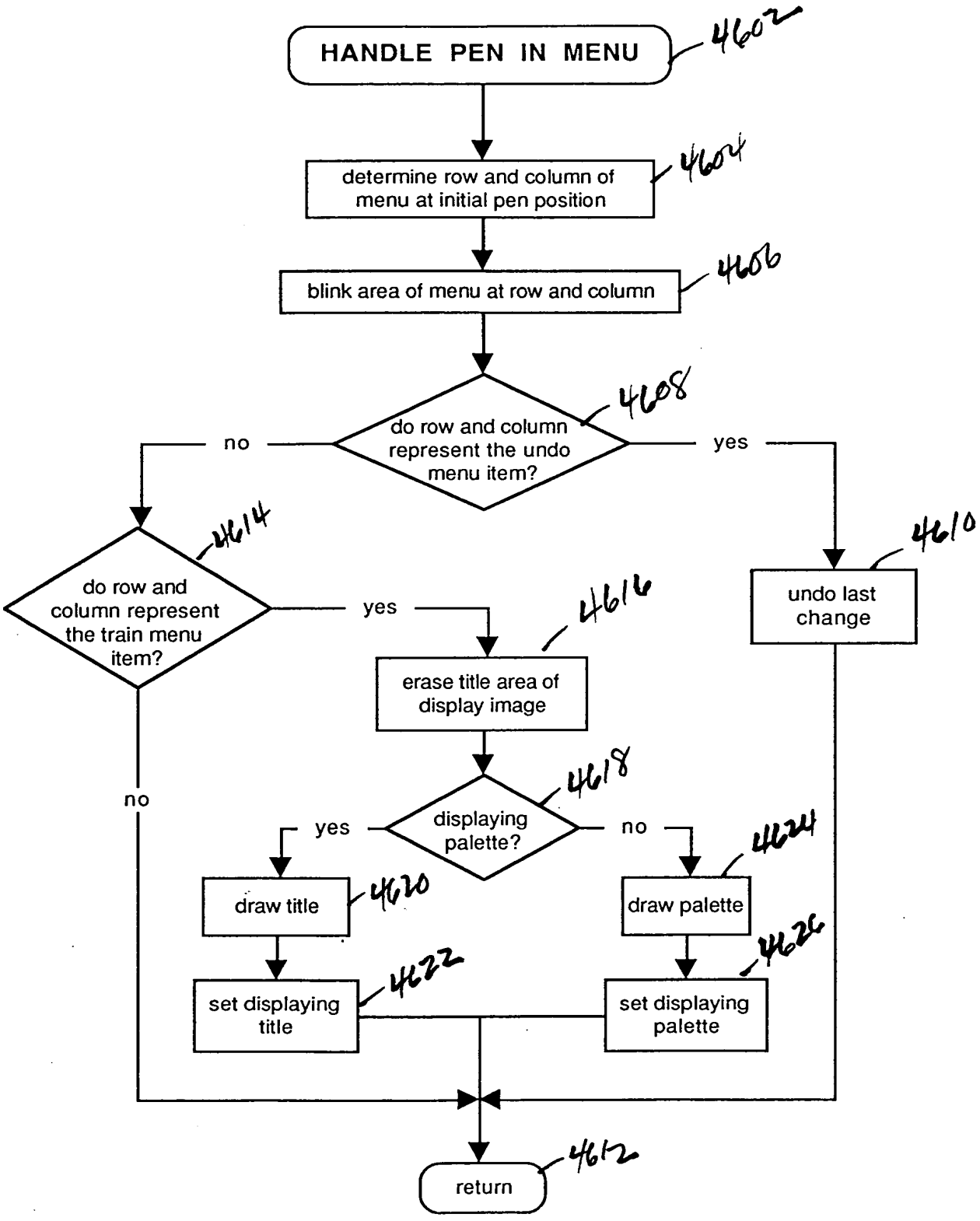
HANDLE PEN IN MENU
4602
determine row and column of menu at initial pen position
4604
blink area of menu at row and column
4606
do row and column represent the undo menu item?
4608
no
yes
undo last change
4610
do row and column represent the train menu item?
4614
yes
erase title area of display image
4616
displaying palette?
4618
yes
no
draw title
4620
set displaying title
4622
draw palette
4624
set displaying palette
4626
no
return
4612

Fig. 46

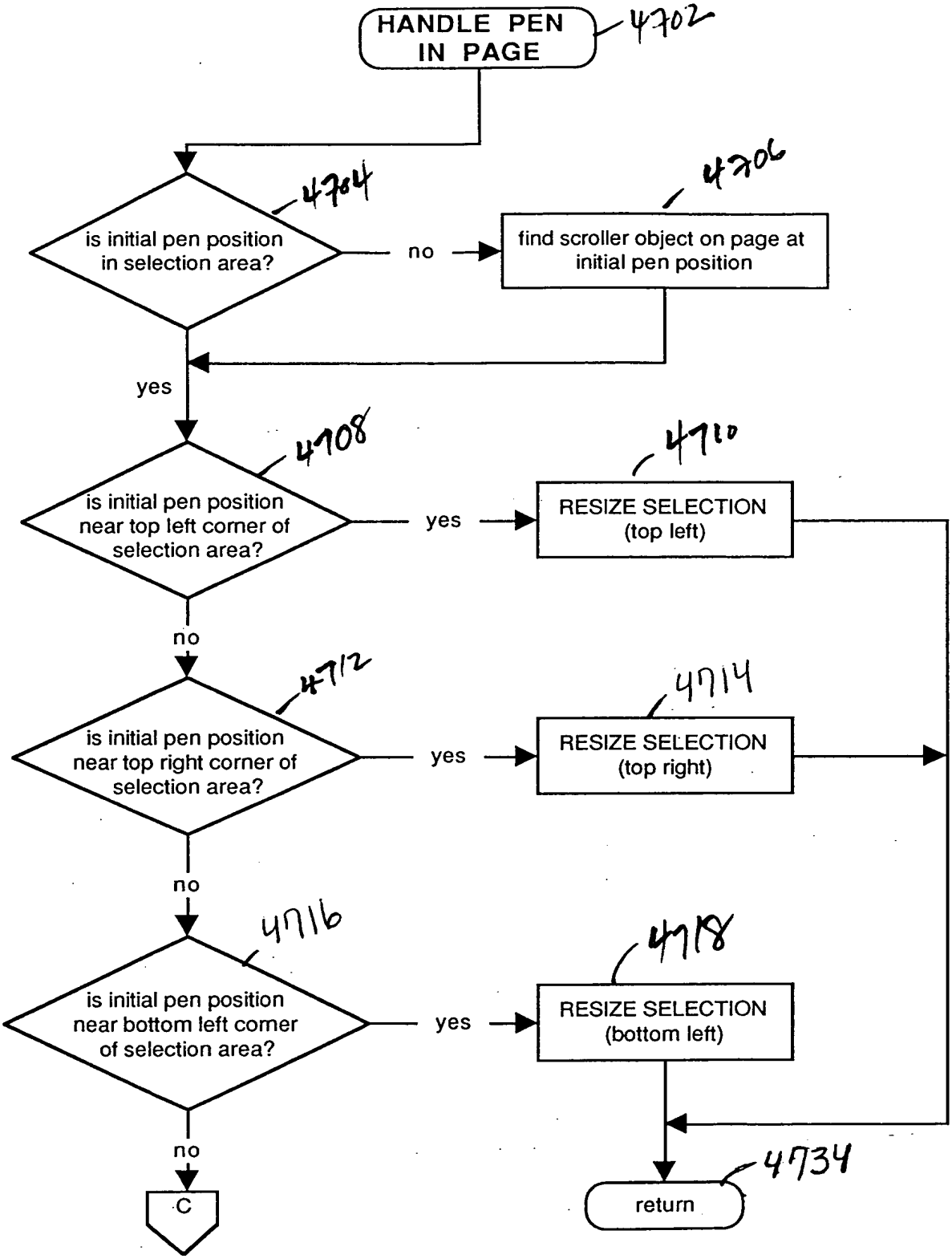
HANDLE PEN IN PAGE
4702
is initial pen position in selection area?
4704
no
find scroller object on page at initial pen position
4706
yes
is initial pen position near top left corner of selection area?
4708
yes
RESIZE SELECTION (top left)
4710
no
is initial pen position near top right corner of selection area?
4712
yes
RESIZE SELECTION (top right)
4714
no
is initial pen position near bottom left corner of selection area?
4716
yes
RESIZE SELECTION (bottom left)
4718
no
C
return
4734

Fig. 47A

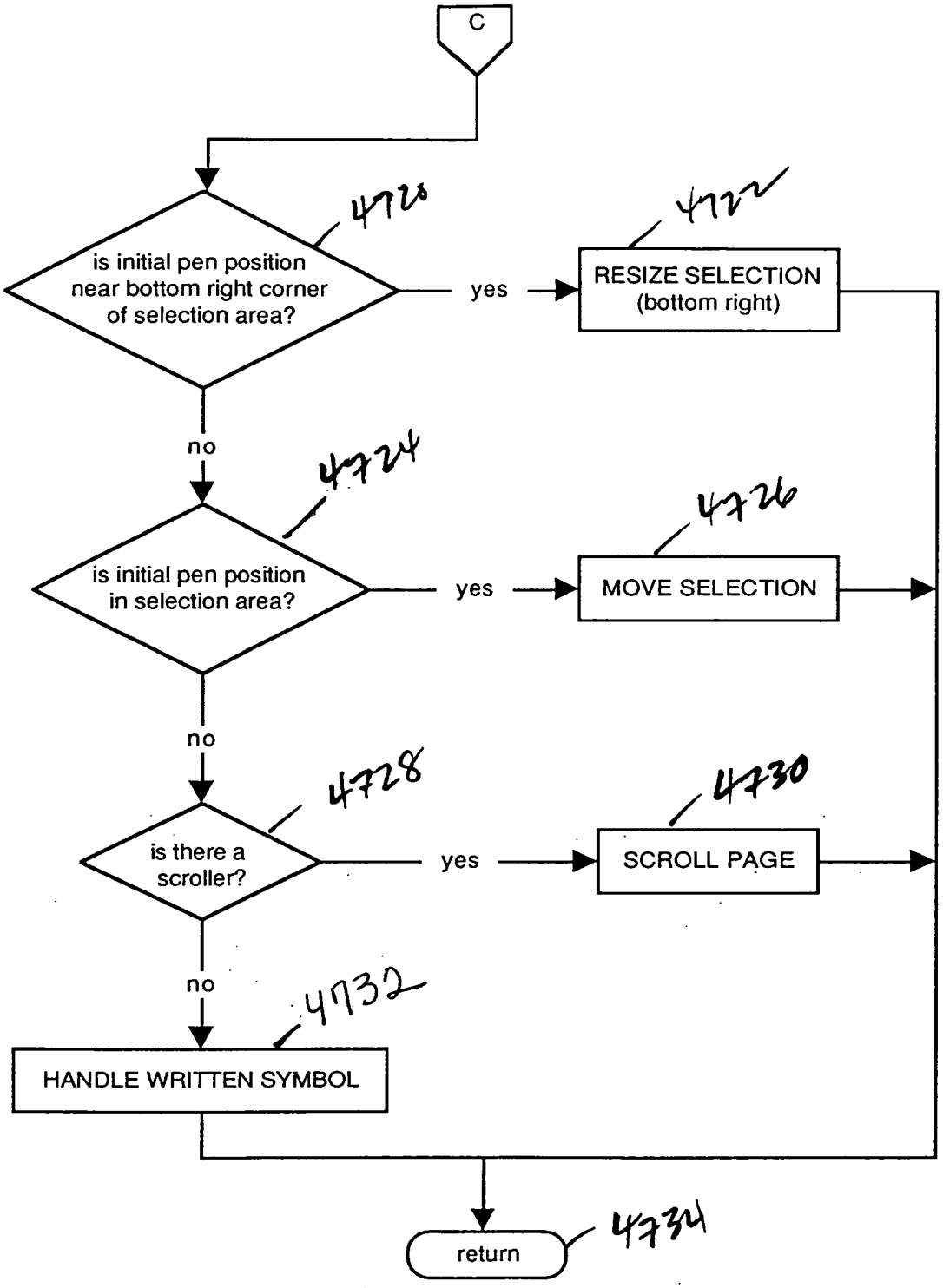
C
4720
is initial pen position near bottom right corner of selection area?
yes
4722
RESIZE SELECTION (bottom right)
no
4724
is initial pen position in selection area?
yes
4726
MOVE SELECTION
no
4728
is there a scroller?
yes
4730
SCROLL PAGE
no
4732
HANDLE WRITTEN SYMBOL
return
4734

Fig. 47B

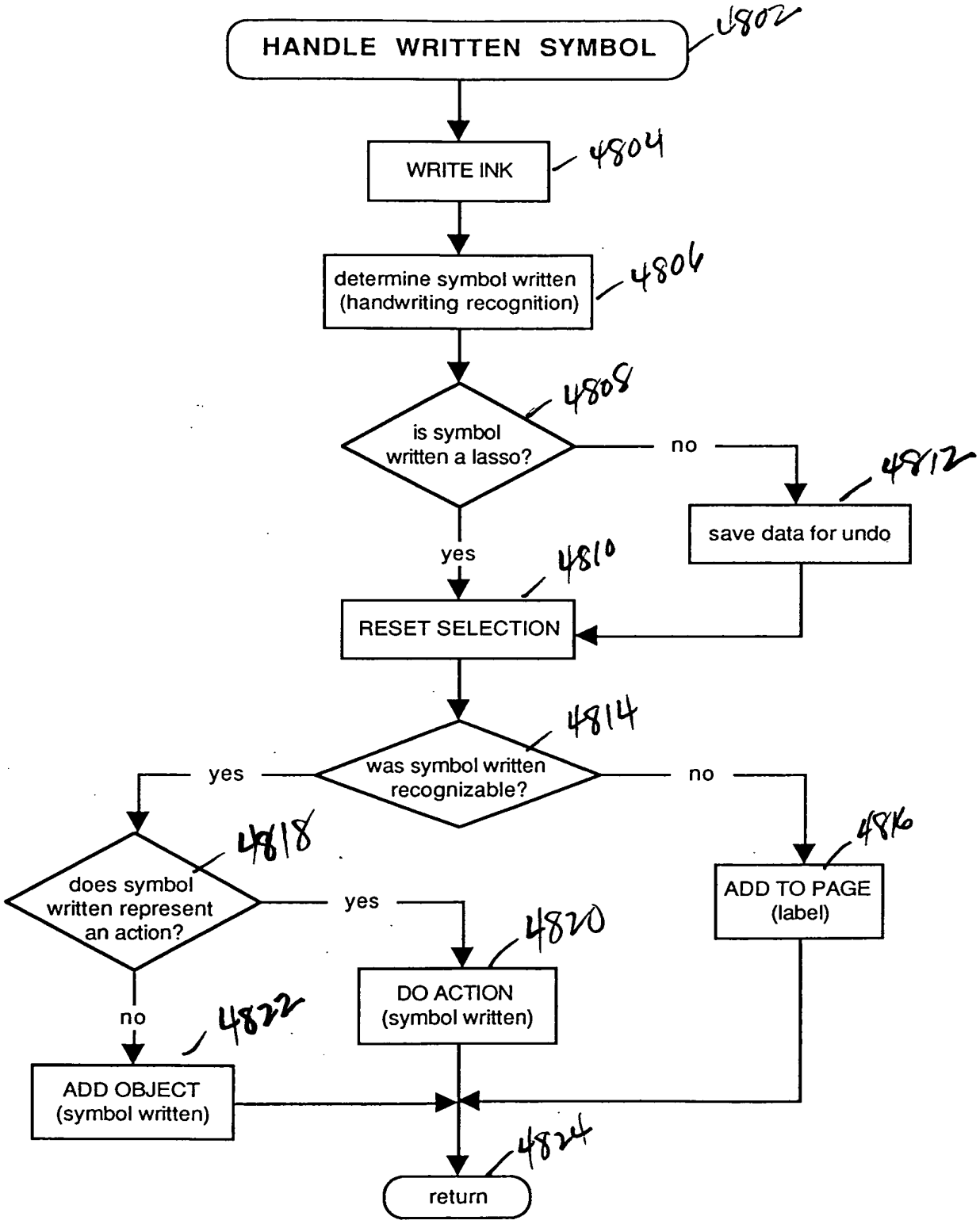
HANDLE WRITTEN SYMBOL
4802
WRITE INK
4804
determine symbol written (handwriting recognition)
4806
is symbol written a lasso?
4808
no
save data for undo
4812
yes
RESET SELECTION
4810
was symbol written recognizable?
4814
yes
no
does symbol written represent an action?
4818
yes
ADD TO PAGE (label)
4816
DO ACTION (symbol written)
4820
no
ADD OBJECT (symbol written)
4822
return
4824

Fig. 48

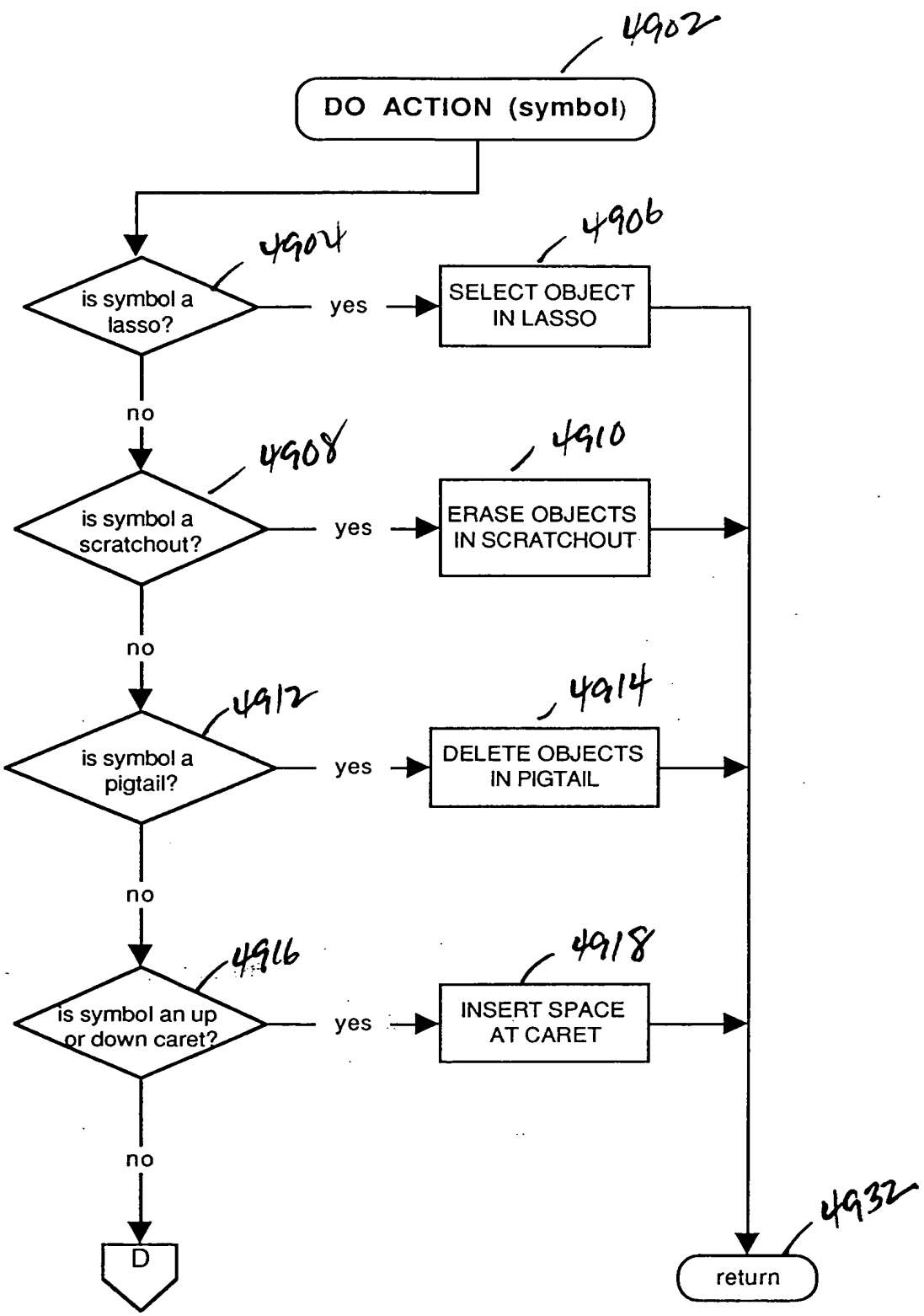
4902
DO ACTION (symbol)
4904
is symbol a lasso?
yes
4906
SELECT OBJECT IN LASSO
no
4908
is symbol a scratchout?
yes
4910
ERASE OBJECTS IN SCRATCHOUT
no
4912
is symbol a pigtail?
yes
4914
DELETE OBJECTS IN PIGTAIL
no
4916
is symbol an up or down caret?
yes
4918
INSERT SPACE AT CARET
no
D
4932
return

Fig. 49A

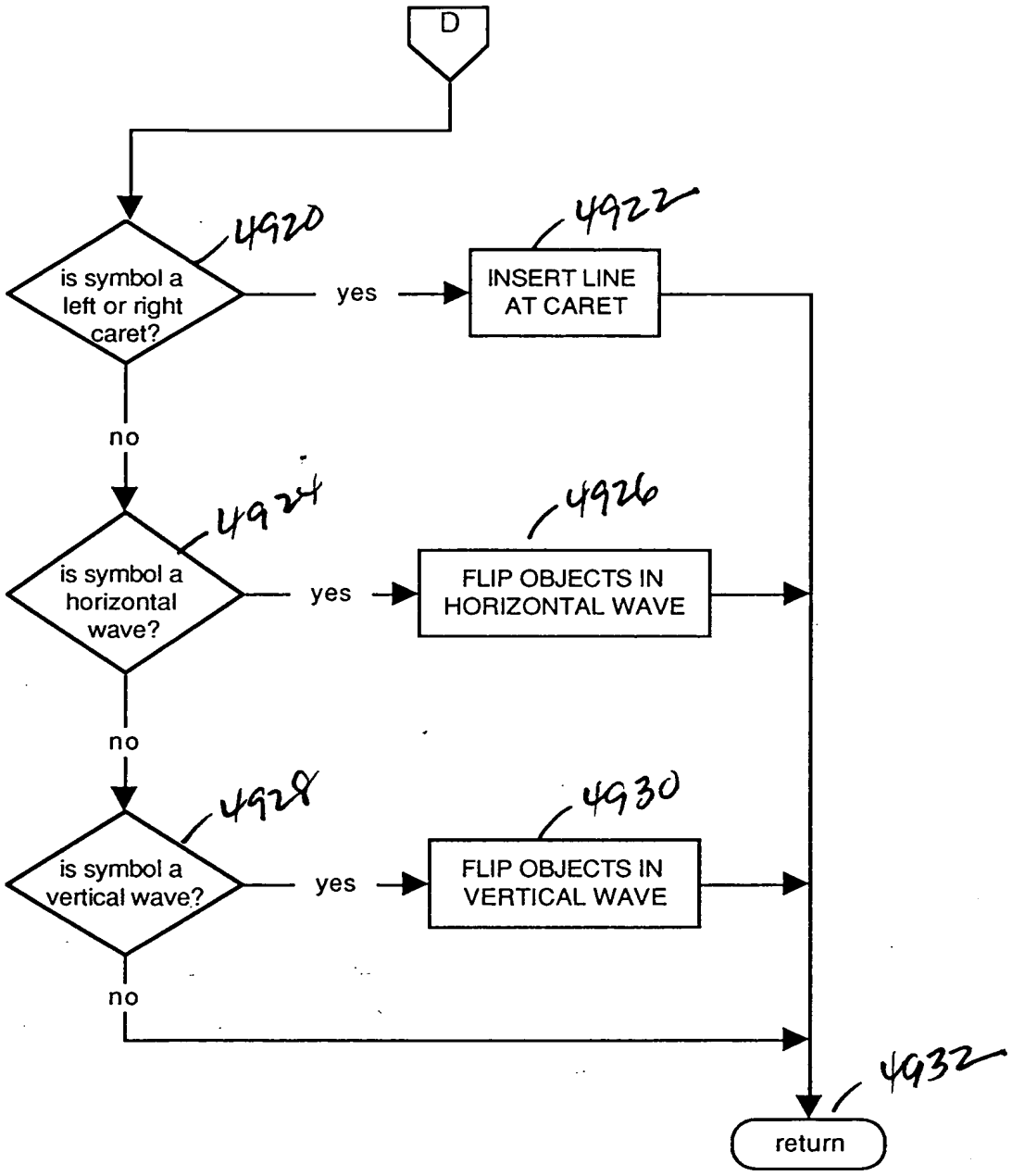
D
4920
is symbol a left or right caret?
yes
4922
INSERT LINE AT CARET
no
4924
is symbol a horizontal wave?
yes
4926
FLIP OBJECTS IN HORIZONTAL WAVE
no
4928
is symbol a vertical wave?
yes
4930
FLIP OBJECTS IN VERTICAL WAVE
no
4932
return

Fig. 49B

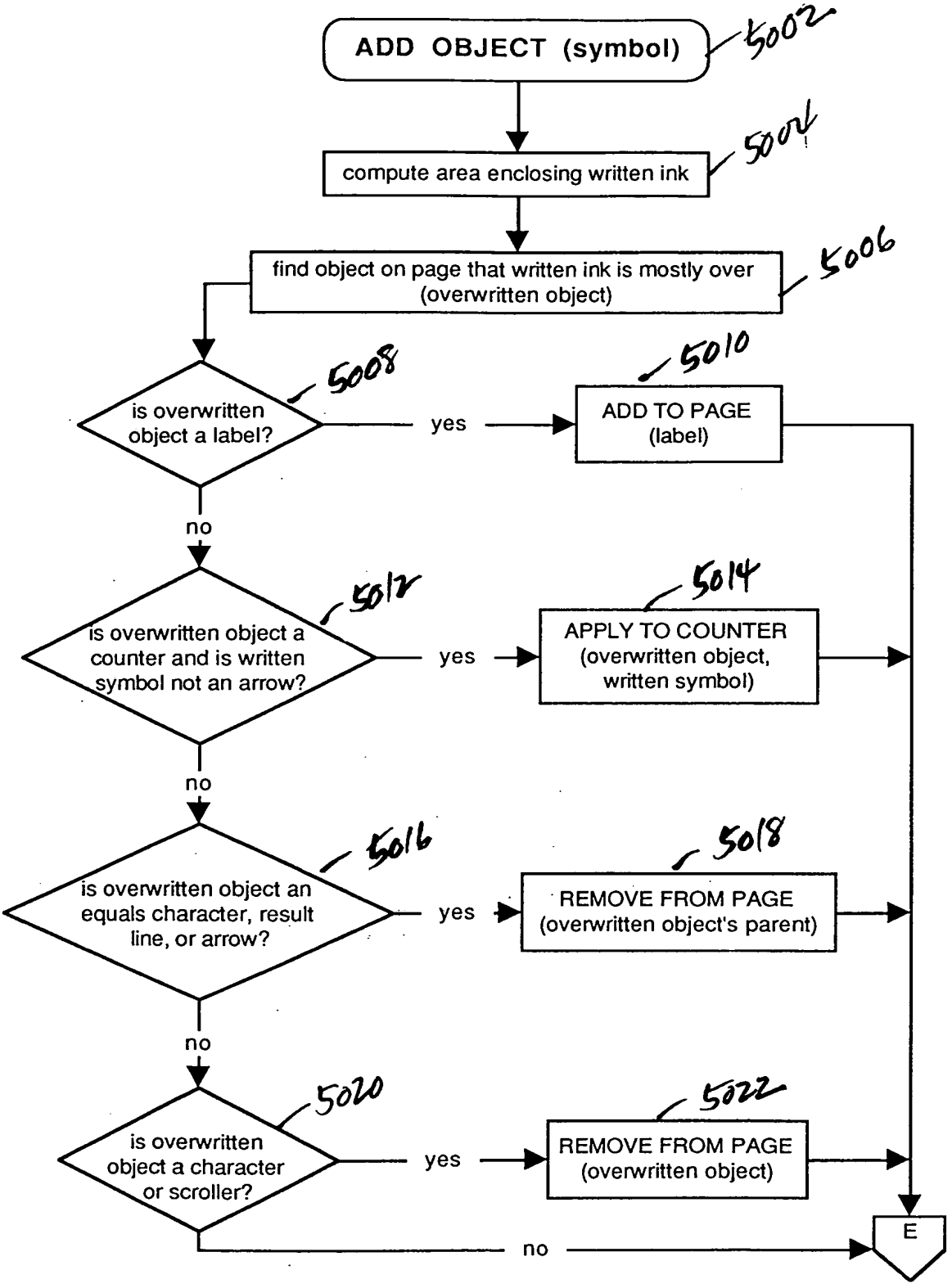
ADD OBJECT (symbol)
5002
compute area enclosing written ink
5004
find object on page that written ink is mostly over (overwritten object)
5006
is overwritten object a label?
5008
yes
ADD TO PAGE (label)
5010
no
is overwritten object a counter and is written symbol not an arrow?
5012
yes
APPLY TO COUNTER (overwritten object, written symbol)
5014
no
is overwritten object an equals character, result line, or arrow?
5016
yes
REMOVE FROM PAGE (overwritten object's parent)
5018
no
is overwritten object a character or scroller?
5020
yes
REMOVE FROM PAGE (overwritten object)
5022
no
E

Fig. 50A

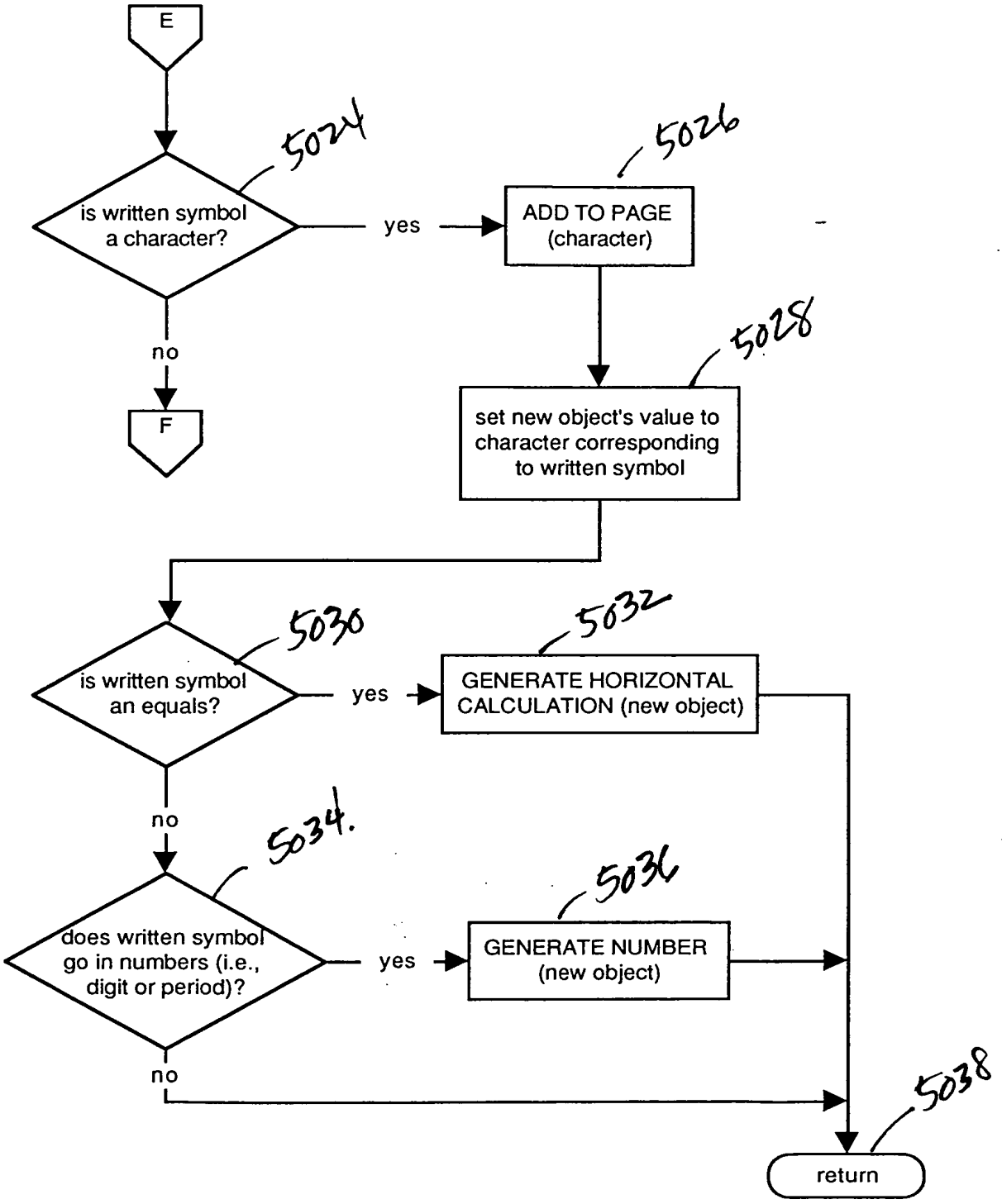
E
5024
is written symbol a character?
yes
5026
ADD TO PAGE (character)
no
F
5028
set new object's value to character corresponding to written symbol
5030
is written symbol an equals?
yes
5032
GENERATE HORIZONTAL CALCULATION (new object)
no
5034
does written symbol go in numbers (i.e., digit or period)?
yes
5036
GENERATE NUMBER (new object)
no
5038
return

Fig. 50B

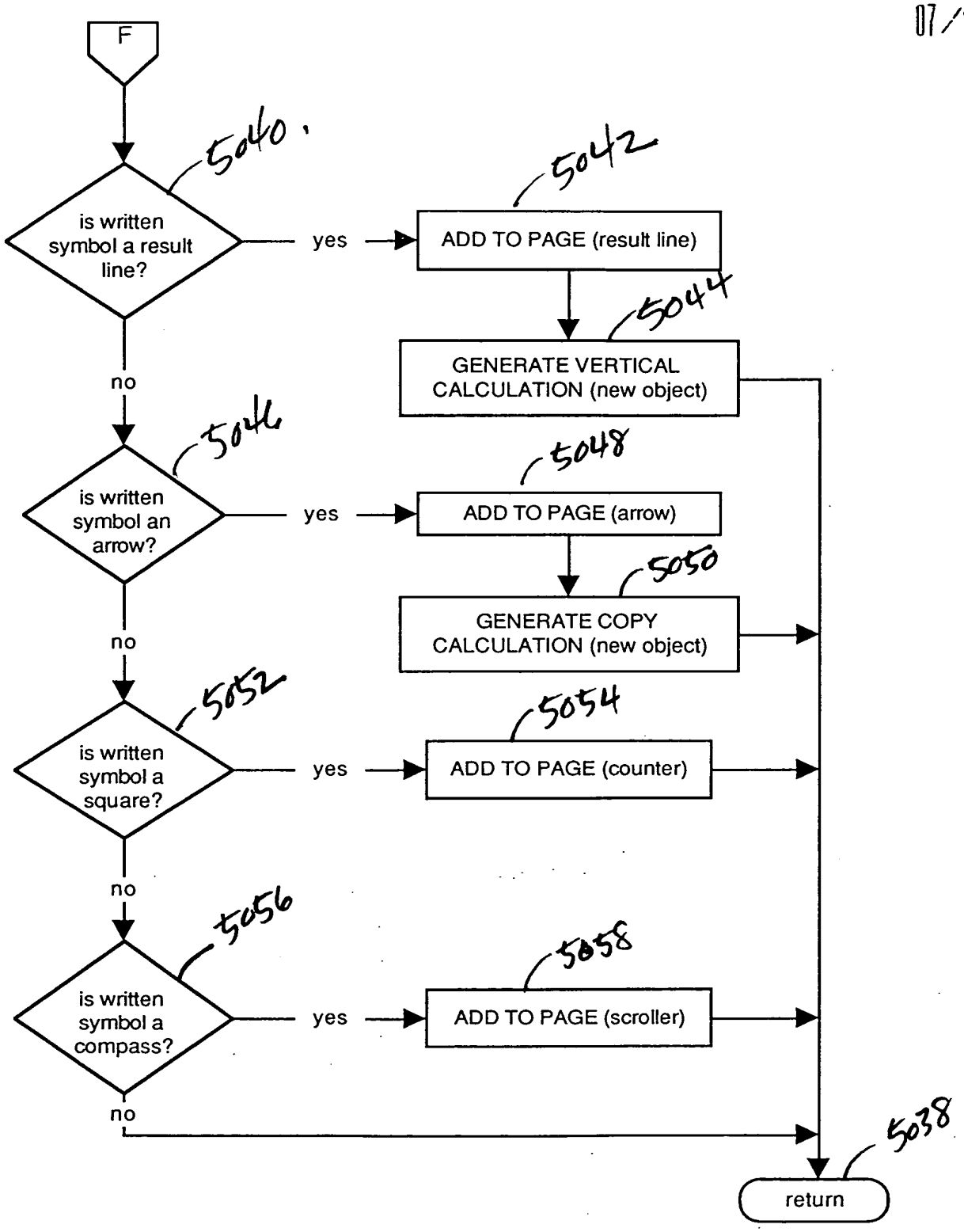
F
5040
is written symbol a result line?
yes
5042
ADD TO PAGE (result line)
5044
GENERATE VERTICAL CALCULATION (new object)
no
5046
is written symbol an arrow?
yes
5048
ADD TO PAGE (arrow)
5050
GENERATE COPY CALCULATION (new object)
no
5052
is written symbol a square?
yes
5054
ADD TO PAGE (counter)
no
5056
is written symbol a compass?
yes
5058
ADD TO PAGE (scroller)
no
5038
return

Fig. 50C

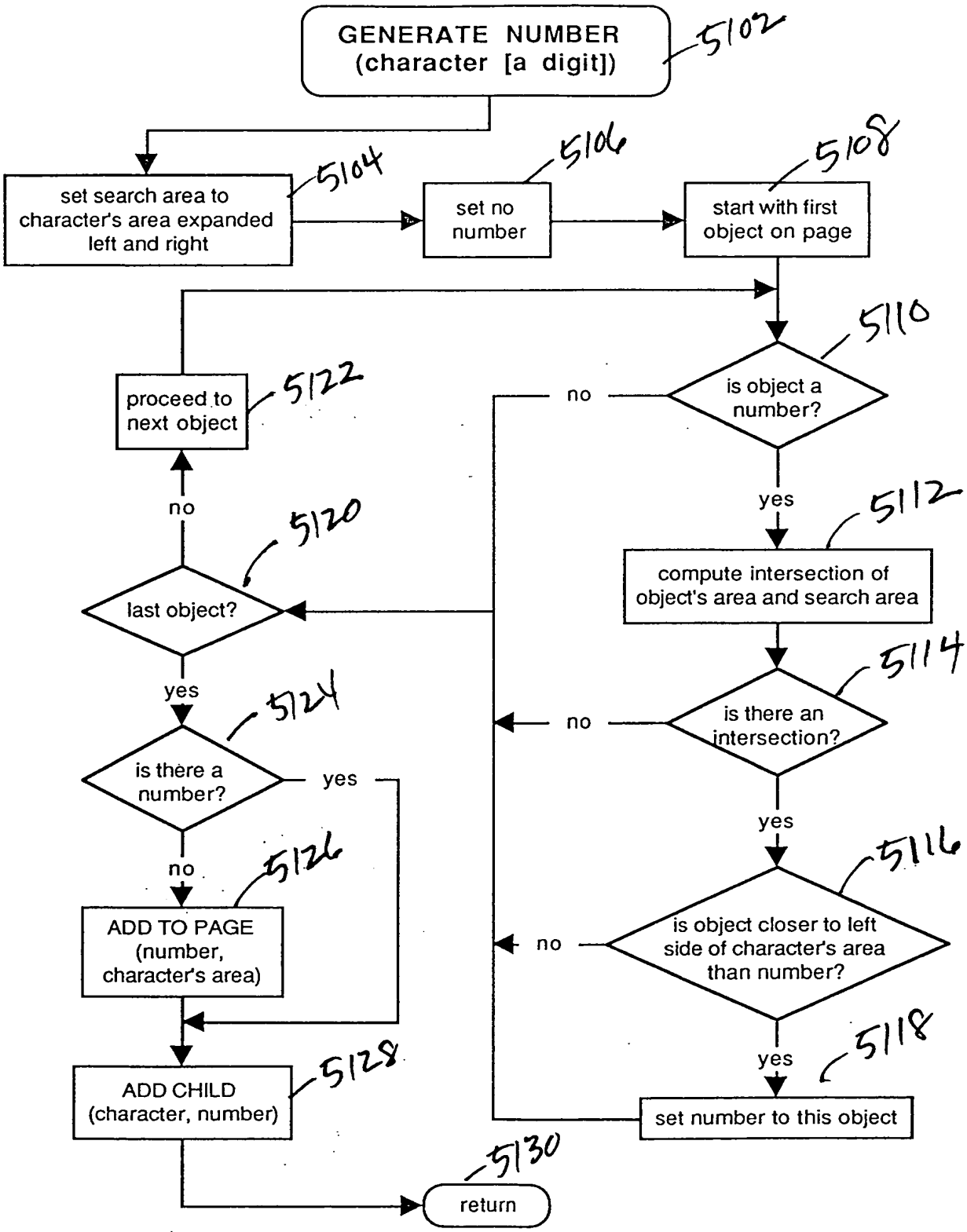
GENERATE NUMBER (character [a digit])
5102
set search area to character's area expanded left and right
5104
set no number
5106
start with first object on page
5108
is object a number?
5110
no
yes
compute intersection of object's area and search area
5112
is there an intersection?
5114
no
yes
is object closer to left side of character's area than number?
5116
no
yes
set number to this object
5118
last object?
5120
no
yes
proceed to next object
5122
is there a number?
5124
yes
no
ADD TO PAGE (number, character's area)
5126
ADD CHILD (character, number)
5128
return
5130

Fig. 51

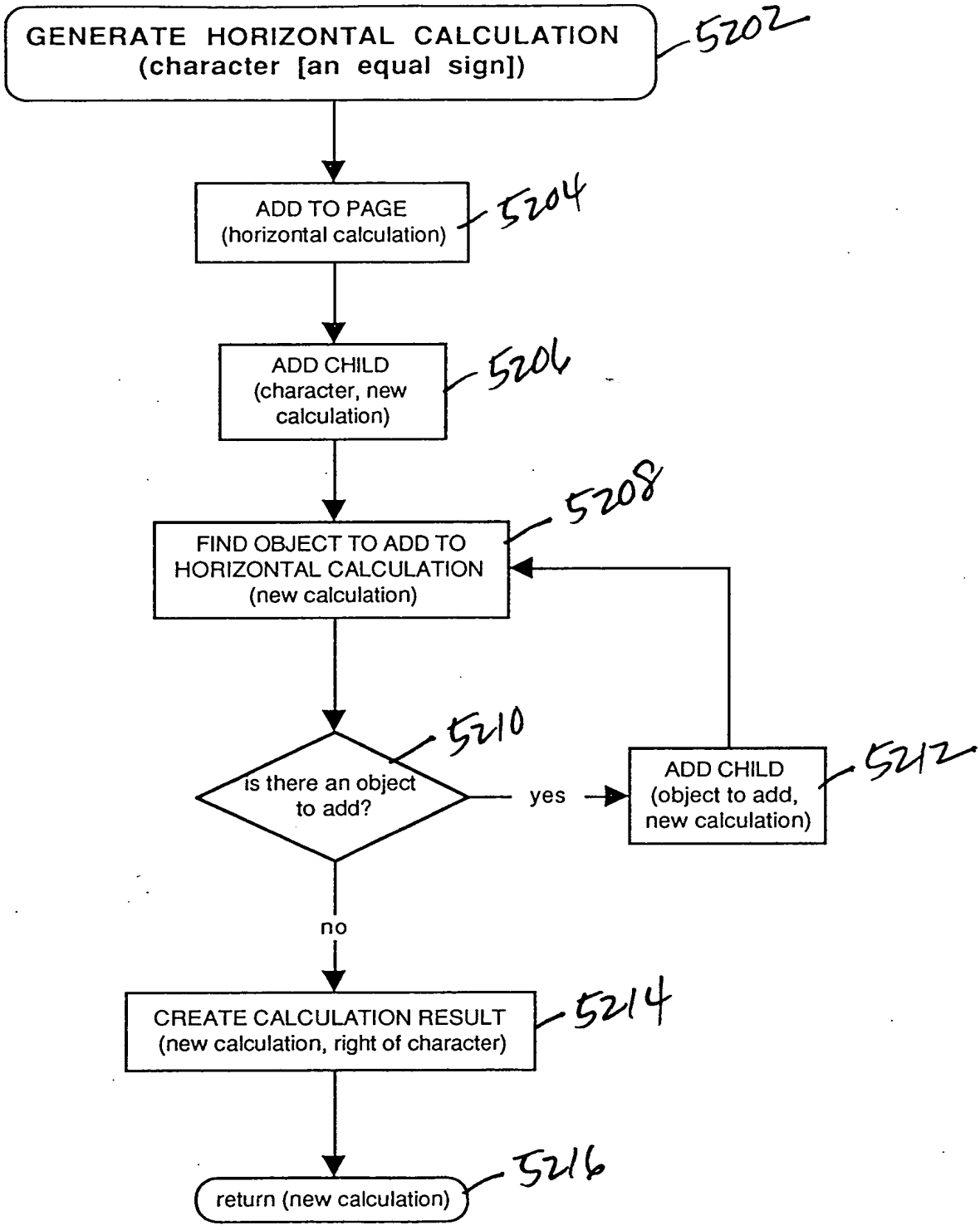
GENERATE HORIZONTAL CALCULATION (character [an equal sign])
5202
ADD TO PAGE (horizontal calculation)
5204
ADD CHILD (character, new calculation)
5206
FIND OBJECT TO ADD TO HORIZONTAL CALCULATION (new calculation)
5208
is there an object to add?
5210
yes
ADD CHILD (object to add, new calculation)
5212
no
CREATE CALCULATION RESULT (new calculation, right of character)
5214
return (new calculation)
5216

Fig. 52

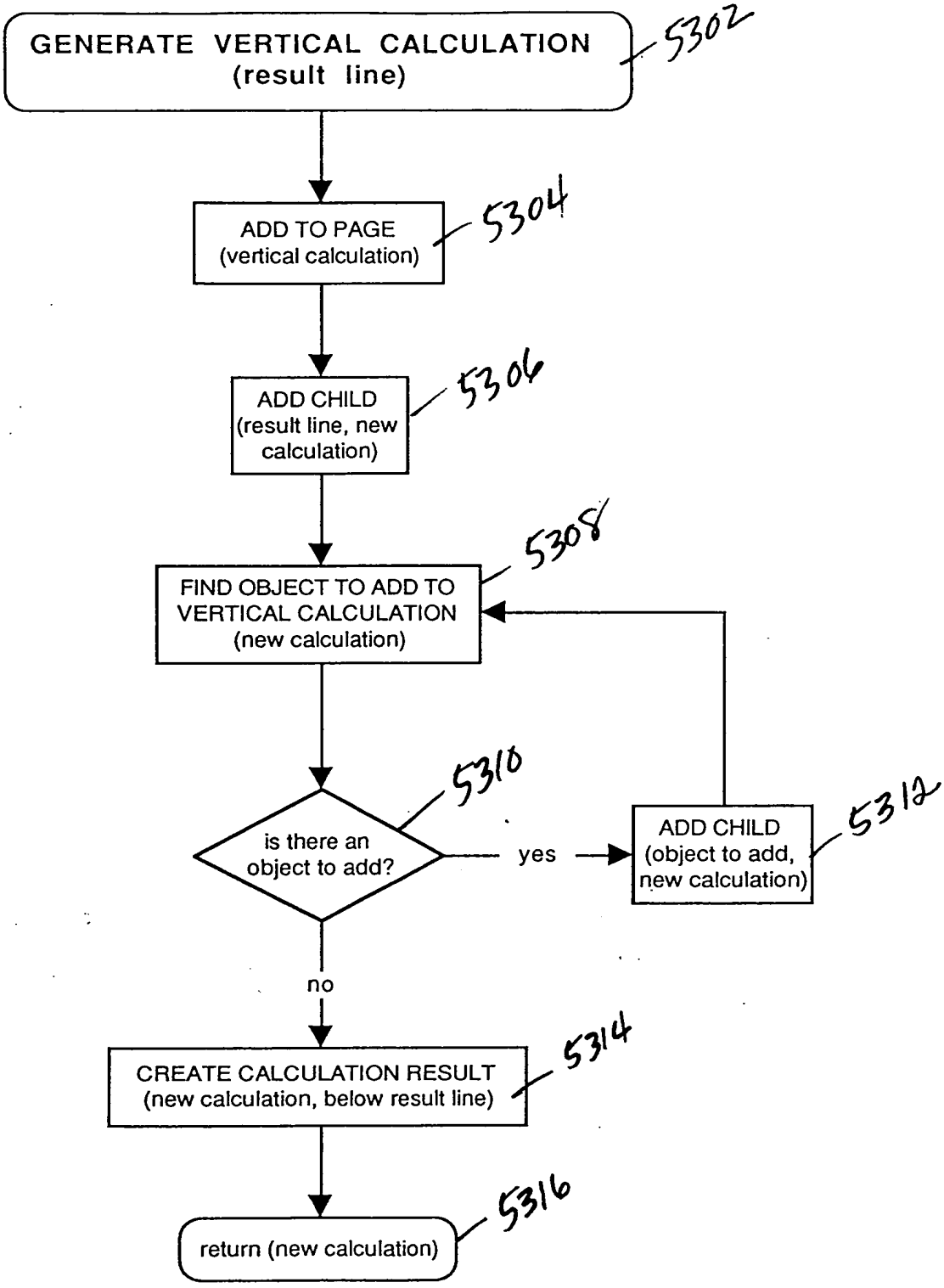
GENERATE VERTICAL CALCULATION (result line)
5302
ADD TO PAGE (vertical calculation)
5304
ADD CHILD (result line, new calculation)
5306
FIND OBJECT TO ADD TO VERTICAL CALCULATION (new calculation)
5308
is there an object to add?
5310
yes
ADD CHILD (object to add, new calculation)
5312
no
CREATE CALCULATION RESULT (new calculation, below result line)
5314
return (new calculation)
5316

Fig. 53

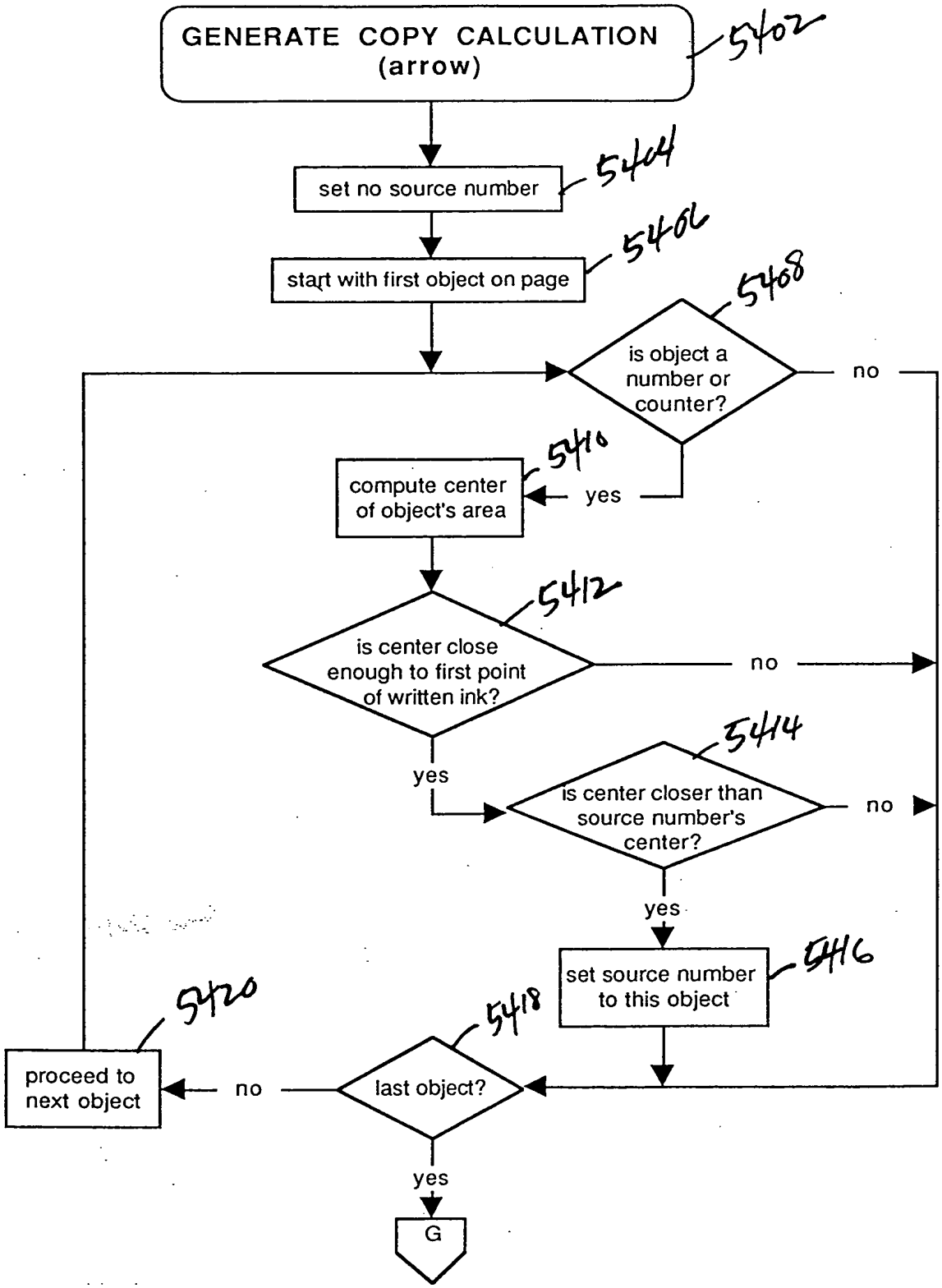
GENERATE COPY CALCULATION (arrow)
5402
set no source number
5404
start with first object on page
5406
is object a number or counter?
5408
no
yes
compute center of object's area
5410
is center close enough to first point of written ink?
5412
no
yes
is center closer than source number's center?
5414
no
yes
set source number to this object
5416
last object?
5418
no
proceed to next object
5420
yes
G

Fig. 54A

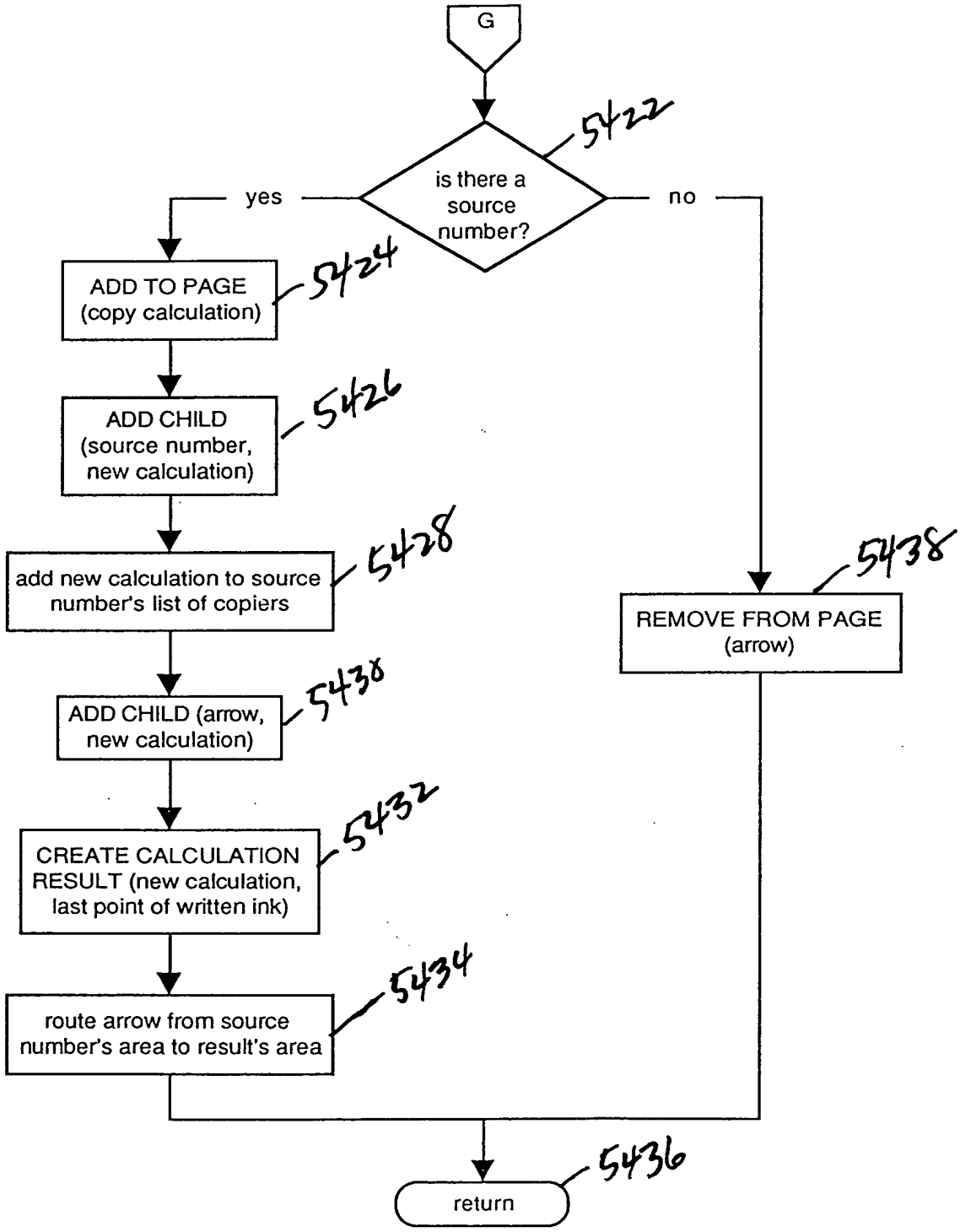
G
5422
is there a source number?
yes
no
ADD TO PAGE (copy calculation)
5424
ADD CHILD (source number, new calculation)
5426
add new calculation to source number's list of copiers
5428
ADD CHILD (arrow, new calculation)
5430
CREATE CALCULATION RESULT (new calculation, last point of written ink)
5432
route arrow from source number's area to result's area
5434
REMOVE FROM PAGE (arrow)
5438
return
5436

Fig. 54B

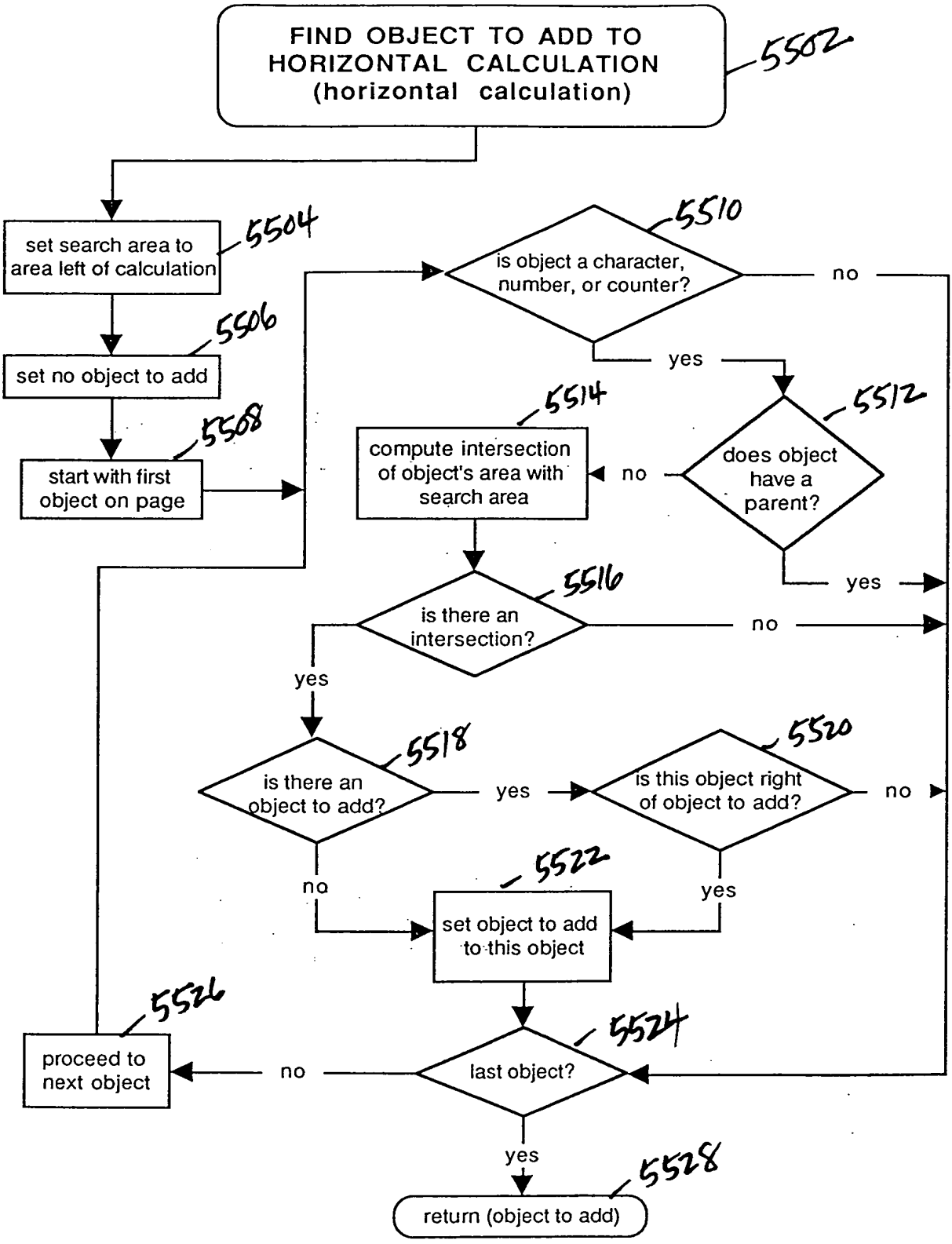
FIND OBJECT TO ADD TO HORIZONTAL CALCULATION (horizontal calculation)
5502
set search area to area left of calculation
5504
set no object to add
5506
start with first object on page
5508
is object a character, number, or counter?
5510
no
yes
does object have a parent?
5512
no
compute intersection of object's area with search area
5514
yes
is there an intersection?
5516
no
yes
is there an object to add?
5518
yes
is this object right of object to add?
5520
no
no
yes
set object to add to this object
5522
proceed to next object
5526
no
last object?
5524
yes
return (object to add)
5528

Fig. 55

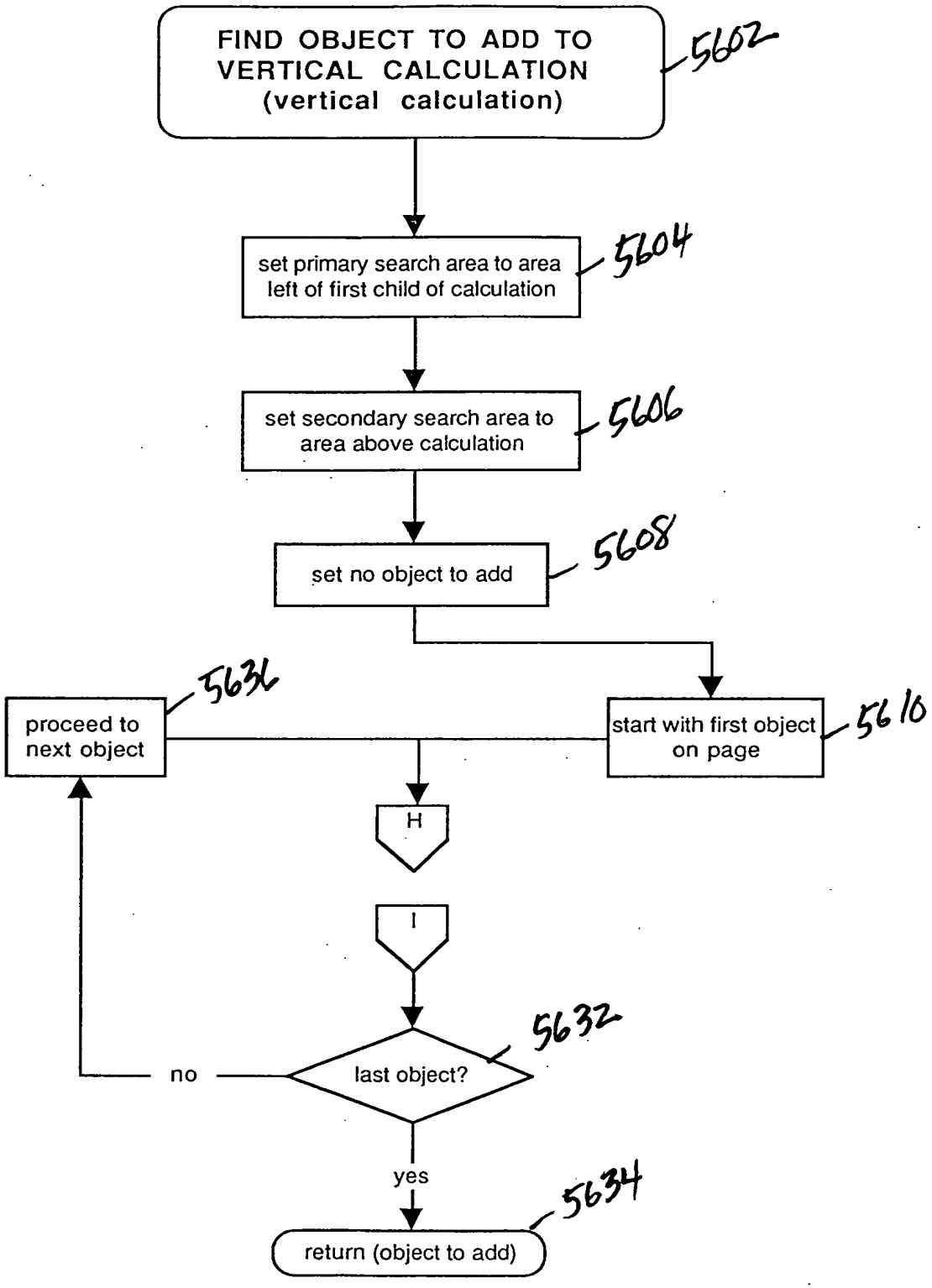
FIND OBJECT TO ADD TO VERTICAL CALCULATION (vertical calculation)
5602
set primary search area to area left of first child of calculation
5604
set secondary search area to area above calculation
5606
set no object to add
5608
proceed to next object
5636
start with first object on page
5610
H
I
last object?
5632
no
yes
return (object to add)
5634

Fig. 56A

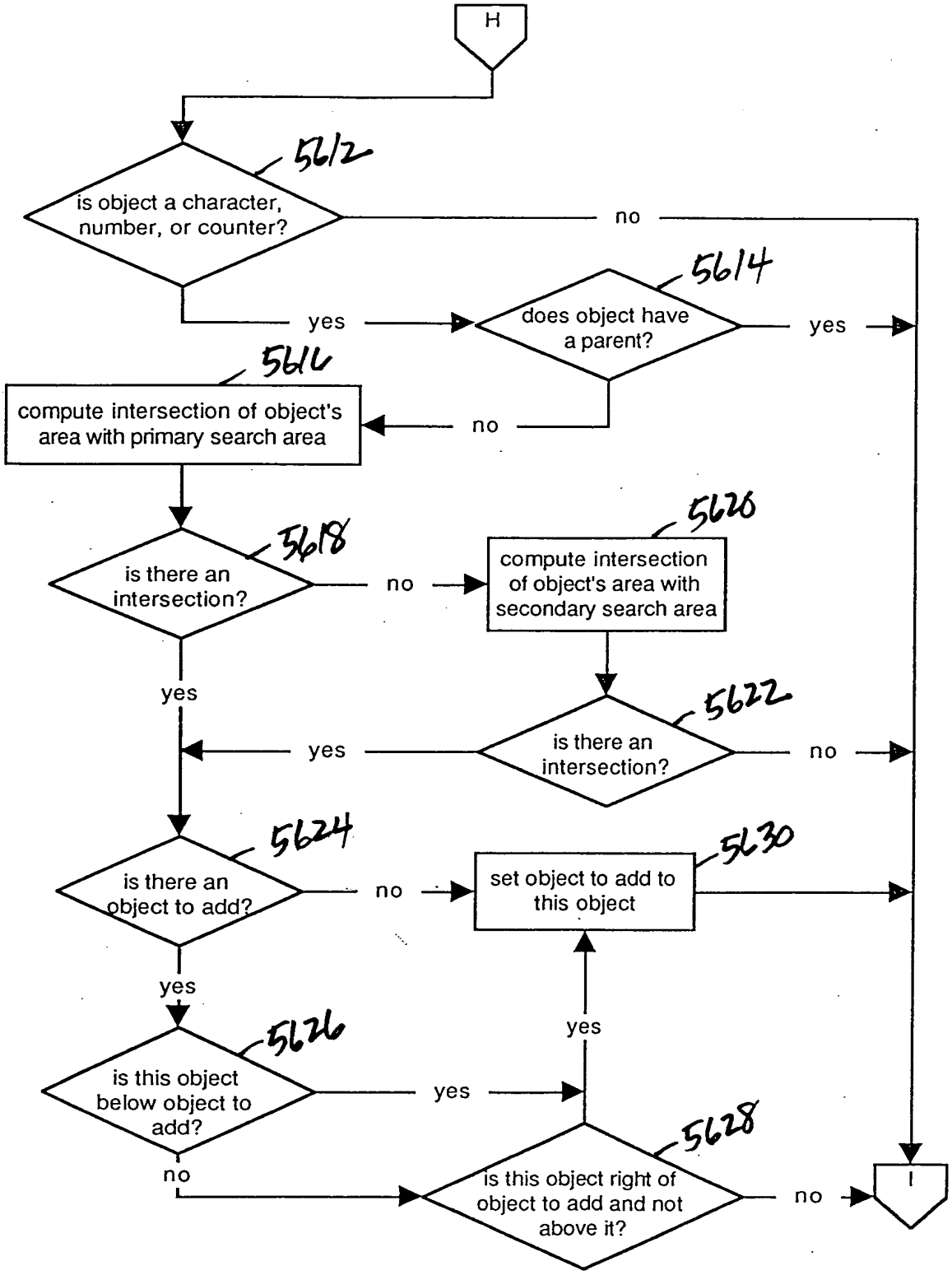
H
5612
is object a character, number, or counter?
no
yes
5614
does object have a parent?
yes
no
5616
compute intersection of object's area with primary search area
5618
is there an intersection?
no
5620
compute intersection of object's area with secondary search area
yes
5622
is there an intersection?
yes
no
5624
is there an object to add?
no
5630
set object to add to this object
yes
5626
is this object below object to add?
yes
yes
no
5628
is this object right of object to add and not above it?
no
I

Fig. 56B

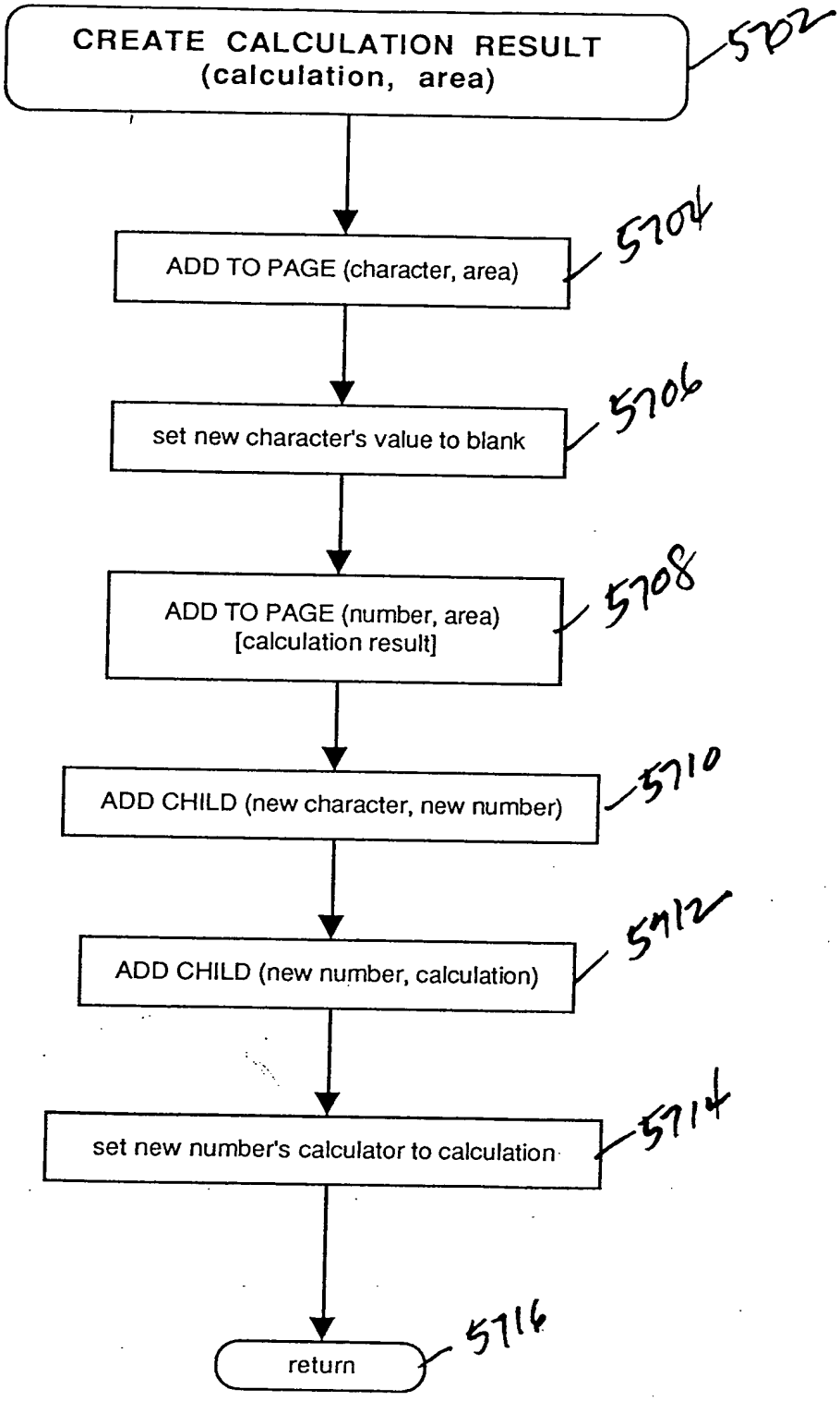
CREATE CALCULATION RESULT
(calculation, area)
5702
ADD TO PAGE (character, area)
5704
set new character's value to blank
5706
ADD TO PAGE (number, area)
[calculation result]
5708
ADD CHILD (new character, new number)
5710
ADD CHILD (new number, calculation)
5712
set new number's calculator to calculation
5714
return
5716

Fig. 57

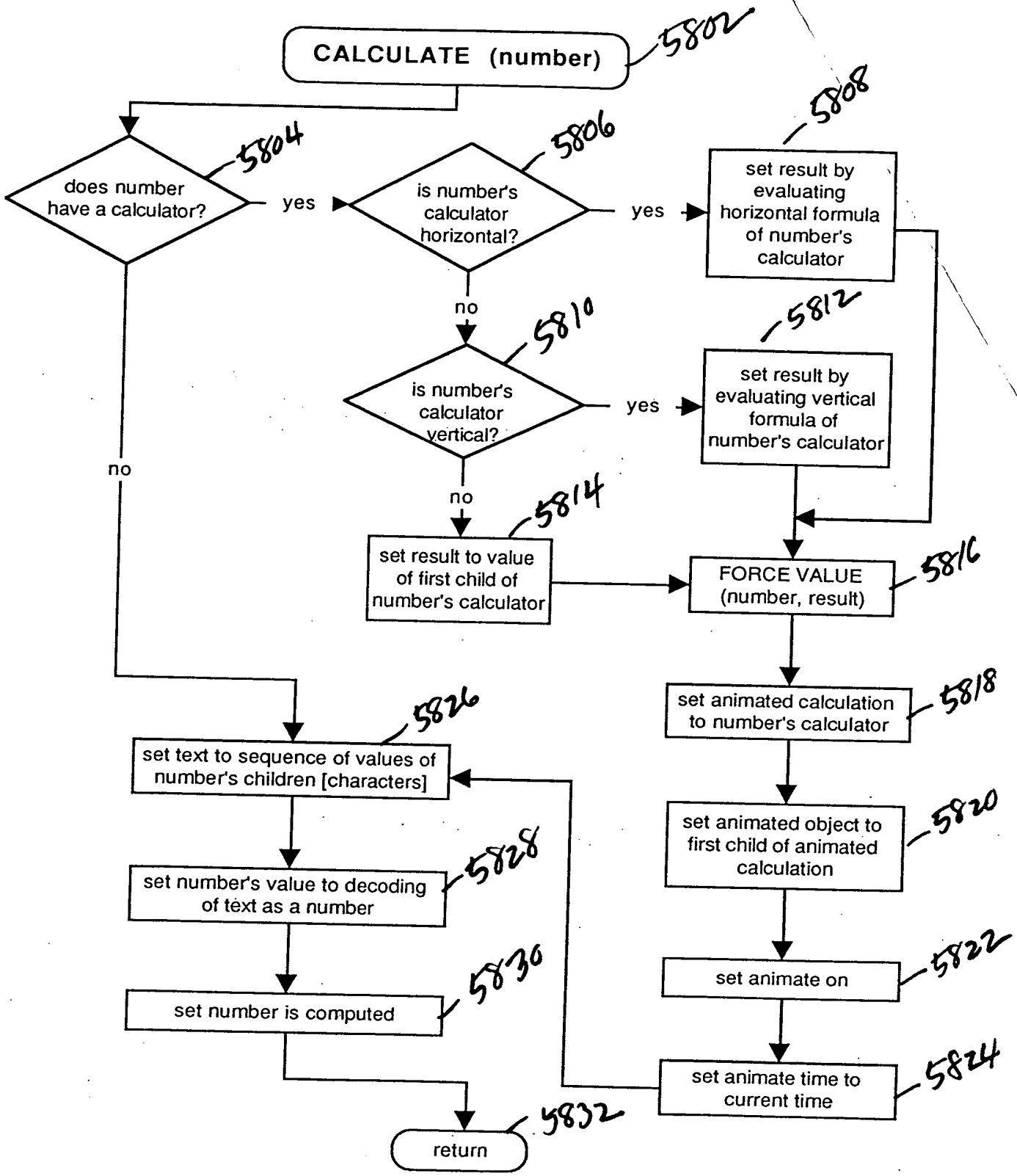
CALCULATE (number)
5802
does number have a calculator?
5804
yes
is number's calculator horizontal?
5806
yes
set result by evaluating horizontal formula of number's calculator
5808
no
is number's calculator vertical?
5810
yes
set result by evaluating vertical formula of number's calculator
5812
no
set result to value of first child of number's calculator
5814
FORCE VALUE (number, result)
5816
no
set animated calculation to number's calculator
5818
set animated object to first child of animated calculation
5820
set animate on
5822
set animate time to current time
5824
set text to sequence of values of number's children [characters]
5826
set number's value to decoding of text as a number
5828
set number is computed
5830
return
5832

Fig. 58